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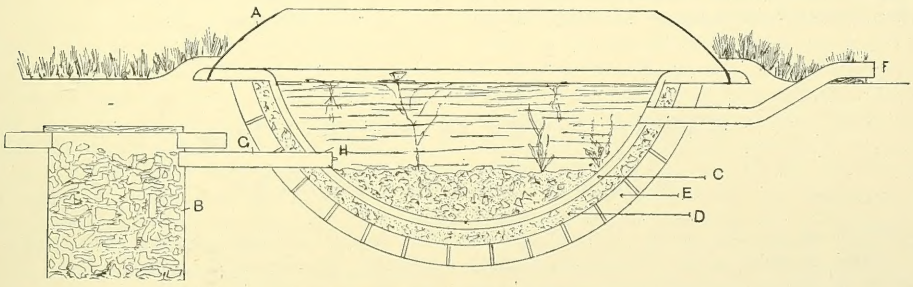
A GARDEN POND.

By J. Leonard Monk.

THERE are many points wrapt in doubt and mystery connected with the aquatic life of our freshwater tarns and rivers. As instances, we may cite such cases as the necessity of better observation of those small worm-like animals, the Gasterotricha, little understood as yet; the discovery of the males of some species of Rotifers; and better knowledge of the aquatic caterpillars of certain moths, "china marks," etc. There is undoubtedly much more to be learnt of the development and life history of aquatic insects by a careful study of them in their natural surroundings. Even to willing workers, however, in this field of research it is often only on special occasions they are able to pursue their investigations, especially if they should find themselves time-hampered, unfortunate town-workers, as is the case with the writer.

To overcome these difficulties, however, I resolved to try an experiment which has worked most satisfactorily, bearing good results. It is therefore the object in this article to give a short description of the method used, that others may also share the pleasure and instruction afforded by it.



Construction of a Garden Pond.

A. Sloping zinc border. B. Outlet cavity. C. Layer of fine cement. D. Layer of rough cement. E. Layer of bricks. F. Inlet pipe. G. Outlet pipe. H. Stopper.

The plan consisted in making a small garden pond, of which the illustration gives a sectional view. I have found the dimensions 4 feet in diameter by about 1 foot 6 inches in depth quite large enough for the purpose. An outlet pipe leads into a cavity loosely filled with rubble, to allow the water to drain into the earth. On the other side a feed pipe is fixed, which can be used with the aid of an indiarubber tubing connection, if there is not a convenient water-supply. The bordering zinc should be well tarred and bent over the water at about the angle indicated, which effectually prevents the escape of animals with straying propensities.

This arrangement, both for economy and result, in my estimation, after having given both a fair trial, far surpasses the ordinary glass aquarium. The advantages claimed for it are the following:—A maximum of surface is exposed to the atmosphere, ensuring the freshness of the water and a certain amount of natural food-supply for such animals as frogs and newts, which feed on living insects, worms, etc.; also the natural succession of life takes place month by month. A good supply of aquatic weed should be established on a gravel bottom, to prevent stagnation of waste organic matter, as it is well to change the water as rarely as possible, for the retention of microscopic life. I have not changed the water in my aquarium for the last eighteen months, but it still remains perfectly fresh. A small quantity has, however, been added from time to time to supply loss by evaporation

The most suitable and hardy plants I have found to be frogbit, *Anacharis*, and *Potamogeton*. Other species may, of course, be substituted according to taste and demands.

The stock of animal life to be introduced will depend on the direction in which one's interests are chiefly engaged. My special hobby has more particularly been the Amphibia, which readily make themselves at home; so completely, in fact, that I have had the satisfaction of seeing many of them undertake family matters. Chief among these important events was the pairing and successful oviposition by some *Bombinator pachypus* (fire-bellied toads), which for two years previously had been kept in a glass aquarium without pairing. A few of this brood are still living, having successfully passed their critical juvenile stages.

For the student wishing to follow the development of the common frog, no better medium could be devised. I was less fortunate with *Pelobates*

fuscus (the burrowing toad), as they burrowed out of sight.

The larvae of the three British newts, *Molge cristata*, *M. vulgaris*, and *M. palmata*, are all easily reared, and I have now under observation a brood of *M. alpestris* (the Alpine newt). I regret I was not successful in obtaining any results from the recently described *M. italica*, discovered last year by Count M. Peracca in the South of Italy, a few of which I was fortunate enough to obtain through the kindness of my friend Mr. Boulenger. One method of observing these animals is to suddenly turn a light on at night, when very often some of them can be seen taking a nocturnal stroll round the sides.

An important consideration in striking the balance of the pond life is to have a good representation of mollusca. The species I have found to thrive best are the three common forms: *Paludin avivipara*, *Limnea stagnalis*, and *L. peregra*. The several species of *Planorbis* do not seem to prosper.

The freshwater mussel (*Anodonta*) is handy to keep for dissection, as it is easily kept and will multiply rapidly. On various excursions taken with a Natural History Society I have invariably bottled a little aquatic weed or moss and placed it in the pond on returning home. The result is a fine selection of microscopic life, a list of which would cover most of the common forms. The ova of various beetles and insects develop unexpectedly and furnish hours of serious study. By this means I have just been following with much interest the development of Cheronomons and the pond skater (*Gerris*), with the aid of Miall's work on the "Natural History of Aquatic Insects."

With regard to *Gerris*, by the way, I am able to confirm De Geers's statement that it captures and devours living prey, which Miall rather discredits, as I have actually seen this animal pounce upon and demolish a small fly that had settled on the water.

The above notes have been given merely as examples of the advantage of having material always at hand for any spare hour which may thus be pleasantly and profitably spent. I hope on some future occasion to give a more detailed result of observation and work done in this way.

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NATURE NOTES IN SOUTH AFRICA.

By Major H. A. Cummins, C.M.G., R.A.M.C.

During my stay in South Africa I endeavoured to make a few notes on the natural history of the district through which I passed, and other matters of interest.

In winter the air is cold and invigorating, and, when travelling over the extensive veldt, hares frequently bound from the long grass, and sometimes herds of buck are to be seen. The veldt cat and ant-eater make the ground dangerous to horses, undermining it by burrows. Large holes are to be seen in the ant-hills by which the veldt is usually dotted. They are dug by the ant-eater in its search for food.

The undulating country from Bloemfontein to Pretoria is pleasant for travelling. It is intersected here and there by rivers, which are crossed by drifts or fords for waggons, not by bridges. I imagine that if the Boers could have procured rolling stock for railways capable of crossing the drifts like ox waggons they would have done so, as they seem to have an intolerable dislike to bridges. Excepting for the railways, bridges are practically absent for cart traffic. The process of crossing one of these drifts with a heavily laden waggon is by no means easy. The cutting to the river bed is generally a steep gradient, and the brake has to be put on at the right time, otherwise the waggon or team, perhaps both, suffer considerably by over-running of the waggon. Ascending the other side is usually very difficult, as in wet weather the path is covered by thick mud, which prevents the draught animals taking a foothold, and at the same time clogs the wheels. In dry weather thick dust takes the place of the mud and is nearly as obstructive. If the river is at all flooded a waggon is in danger of upsetting or of being washed away as it bumps from one boulder to another, while several of the oxen may be out of their depth and compelled to swim.

Oxen are strange animals to manage: they travel best at night, feeding only during the day. During the forced marches many succumbed to overwork, as they had to travel nearly all day and during part of the night. When an ox becomes sick or weary he lies down and has to be loosed from the yoke and left behind. If he is not very ill he soon regains his feet, and commences to graze. He will then probably be brought on by a later waggon with a deficient team. If not, he dies or is shot. Mules travel until they are quite worn out. They sometimes drop dead in harness. A mule would be getting into delicate health if he could not accumulate sufficient energy to kick a Cape boy when there was opportunity. These

animals will eat wood, gnawing the disselboom, or pole of a waggon, until it becomes too thin to be of use. Of course, the conditions I have mentioned were only caused by the most urgent necessity. The railway line, bridges, and culverts were often blown to pieces, but still supplies and hospitals had to come to the front.

As a rule waggons can proceed across country regardless of roads, except here and there where boulders occur, or in cultivated tracts. Once the soil is turned up the surface is very soft, such as in "mealie patches," or where Kaffir corn is grown. The whole country appears to be intersected with barbed wire fencing. If this has been put up to keep off lions, it has been most effective.

Trees are scarce unless cultivated near farms or in towns, where they grow to a large size. At Wanderboom, near Pretoria, there is an immense fig-tree, resembling the banyan tree of India, except that it does not throw out secondary roots from its branches. This tree, I estimate, covers an area of 5,000 square feet.

The common house-flies were a terrible pest at Bloemfontein and The Glen. They swarmed on food and irritated the patients in hospital, unless kept away by mosquito-curtains or fans. To some extent we got rid of them from the tents by driving them out at sunset and closing the tent doors, when they settled outside and were in great part killed by the night frost. Small collections of rubbish will rapidly generate enormous numbers of flies in a hot climate. In Pretoria I tested the time required for the eggs of the house-fly and bluebottle-fly to produce the imagines, and I found the period to be under a week.

Flies doubtless act as potent carriers of disease. Bred in garbage, they become soiled in their primary environment. In their after-existence, by frequenting contaminated areas, diseased men and lower animals, and subsequently alighting on those in possession of health, they spread infection. To counteract this, and for other reasons, I instituted a method of pouring all discharges from diseased subjects into a boiling solution ; no flies approached the apparatus, as it was free from odour and gave off great heat. The arrangement produced an absolute holocaust of the lower forms of life ; in fact, after two minutes, life of all kinds became extinct. This system, I have reason to believe, is now used in hospitals in many parts of South Africa, destroying in that country inestimable numbers of those minute specks of living matter, which the inscrutable law of the universe has appointed to perform the function of indiscriminate destruction of human and other life.(1)

Bites from what was locally called the tarantula —a black hairy spider—were not uncommon, and scorpion bites sometimes occurred. I saw two men suffering from small abscesses, each containing a larva about half an inch long by a quarter of an inch thick. I believed them to be the larvae of the *Oestrus livingstonii*. The larvæ on removal were alive, and the abscesses then gave no further trouble. Reference is made to similar larvae in Cobbold's "Human Parasites," an original larva taken from Dr. Livingstone in South Africa was said to be in the Hunterian Museum. By the kindness of one of the curators I was enabled to see this specimen, which I believe was identical in species with those I have described, although a little smaller. But this was probably due to shrinkage caused by the preserving medium.

Rats were a great nuisance, occasionally gnawing the hair of persons during sleep. Snakes were few in my experience ; but I found one under the blanket on which a man had been sleeping.

The ordinary body lice (*Pediculus corporis*) were frequent in the clothes of soldiers. It is difficult to say how they originated. Residents in the country maintain that the lice eggs are in the veldt and in waggons. I never observed any of the ordinary head lice (*Pediculus capitis*) ; but from wherever the body lice came, they amounted to a perfect scourge. When men were admitted to hospital their clothing was put in store. If infected, as was often the case, as soon as the clothes were cold all the lice in the garments would come to the surface. At this time they could be easily destroyed, but they left their eggs in the innermost folds and creases of the garments so well protected that even boiling was of doubtful utility in destroying them, disintegration of the garments usually preceding that of the eggs.

Locusts came in swarms, and if they were as frequent in other parts of the country as they were in the portion through which we marched, they must indeed be very numerous in South Africa. I had an idea that they followed our food convoys ; but if they looked for spare biscuits at Paardeberg they were disappointed. One comfort, at all events, is, that a method of destroying them by infecting some individuals with a species of *Impusa* fungus has been introduced, by which they are rapidly killed. The living ones consume those dead of the fungus disease, and it is thus spread indefinitely.

Ant-hills are very common on the veldt. They form mounds from about two feet to four feet in height, the diameter of the base being some four or five feet. As far as I could see, they are composed of earth mixed with some secretion from the ants. In consistence they are extremely hard, but the wheel of a heavily laden waggon cuts through them. I tried to dissect one, and worked with a pickaxe and spade for nearly an hour, but did not get to the foundation, which appears to be deep in the ground. The interior is excavated by tunnels occupied by many old and young ants, with a store of grass stems cut into portions about half an inch long. The young ants are etiolated, while the old

(1) *Brit. Med. Journal*, April 20th, 1901, p. 954.

ones are of a reddish-brown colour, and possess strong mandibles. Ant-hills were very useful to our soldiers as shelters in the battles. The natives grind the hills into powder, and, mixing them with glue made from skins, use them for floors for huts. The material sets hard like cement. It is also used for making tennis grounds. The Boers frequently whitewashed ant-hills on the veldt to mark the ranges for their guns.

The spruits in Pretoria provided a habitat for land crabs. These animals varied in size from a couple of inches to four or five inches across the shell. They dug holes under the footway, causing considerable damage to the earth above, in consequence of which the tunnels often collapsed after rain.

There is one point which is perhaps worth notice, and that is the method adopted by the Kaffirs for smoking "gunja." They soften the ground with water, and bury in it a portion of a sjambok lash. The lash is pulled through, leaving a subterranean passage: at one end of this passage the "gunja" and a live coal are placed, at the other end of the passage the mouth is applied. Having previously filled the mouth with water, the smoke is drawn into the mouth. The water is then ejected and the smoke exhaled as in ordinary smoking of tobacco.

The possibilities for scientific investigation in South Africa must not be judged from the foregoing notes. They were made often under great difficulties, and cannot be called more than passing observations, more serious occupation generally commanding one's attention. Still, they may be of interest to some readers, and form for myself a reminiscence of a very trying period.

29 *Nightingale Place, Woolwich.*
10*th November*, 1901.

AN INTRODUCTION TO BRITISH SPIDERS.

By Frank Percy Smith.

(*Continued from page* 174.)

GENUS *BATHYPHANTES* MENGE.

THIS genus may be distinguished from the six preceding genera by the metatarsi of the first pair of legs being as long as the tibiae. The femora of the first and second pairs are usually each furnished with a spine, but there are no metatarsal spines. The eyes are arranged in a compact group, the distances between those of the posterior row being less than the diameter of the eyes. The posterior row is almost or quite straight, and the anterior centrals are much smaller than the laterals.

Bathyphantes variegatus Bl. (*Linyphia variegata* in "Spiders of Dorset.")

Length. Male 2 mm., female larger.

The most tangible characteristics are figured. It is a rare spider.

Bathyphantes concolor Wid. (*Theridion filipes* Bl.)

Length. Male 2.5 mm., female slightly larger.

The vulva and palpal organs, which are figured, are very typical. This species is not rare, and is widely distributed.

Bathyphantes approximatus Cb. (*Linyphia approximata* in "Spiders of Dorset.")

Length. Male 2.7 mm., female slightly larger.

Cephalo-thorax dull yellowish-brown, often with some indistinct markings. Palpus of male short. Digital joint with palpal organs very large, almost equalling in length the rest of the palpus.

The palpal organs have, in common with those of several allied spiders, a circularly curved spine at their extremity. Apparently rare.

Bathyphantes nigrinus Westr. (*Linyphia pulla* Bl.)

Length. Male 3 mm., female 3.5 mm.

The palpal organs have a coiled spine at their extremity, but they are considerably smaller than in *B. approximatus*. The vulva is figured. Not rare.

Bathyphantes setiger, F.O.P. Cb.

Length. Male 2 mm.

This species may be at once recognised by the entire absence of femoral spines.

Bathyphantes pullatus Cb. (*Linyphia pullata* in "Spiders of Dorset.")

Length. Male 2.5 mm.

Very closely allied to *B. nigrinus*, but lacks the coiled spine at the extremity of the palpal organs. Rare.

Bathyphantes gracilis Bl. (*Linyphia gracilis* + *L. circumspecta* Bl.)

Length. Male 2 mm.

Abdomen almost white upon its upper surface, with a series of dark transverse markings. The palpal organs are figured. A very common species.

Bathyphantes parvulus Westr. (*Linyphia parvula* in "Spiders of Dorset.")

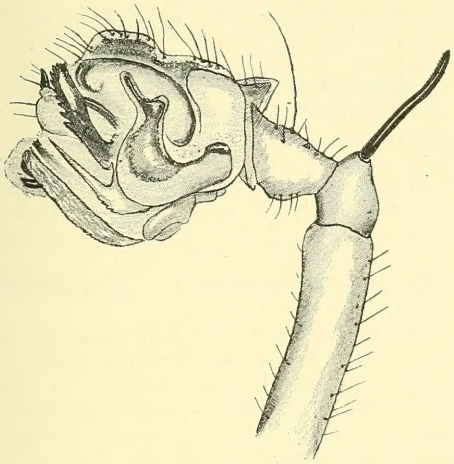
Length. Male 2.5 mm.

Closely allied to *B. gracilis*, but the abdomen is unicolorous. Not common.

Bathyphantes dorsalis Wid. (*Linyphia claytoniae* Bl.)

Length. Male 2.5 mm., female 3 mm.

The colouring of this common species is very



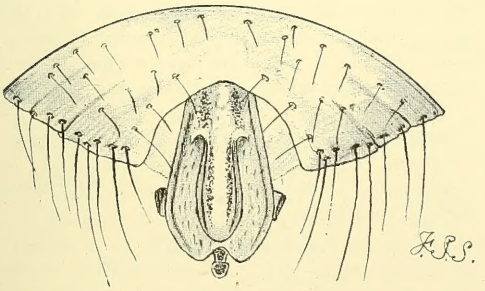


FIG. 1. *Lepthyphantes minutus* Bl. Palpus and vulva highly magnified.

variable. The female may be easily distinguished by the form of the epigynum. A conspicuous process is directed backwards from the vulva, its extremity being thickened and of a rather dark colour.

GENUS *LEPTHYPHANTES* MENGE.

This genus may be distinguished from the closely allied *Bathyphantes* by the presence of at least one spine upon the anterior metatarsi. The femora of the second pair of legs are devoid of spines. Unless stated to the contrary, it may be assumed that the various species were formerly included in the genus *Linyphia*.

Lepthyphantes minutus Bl.

Length. Male 3.5 mm., female 4 mm.

Legs distinctly annulated. The palpal organ and vulva are figured in detail. This species is common, especially in the North of England.

Lepthyphantes leprosus Ohl.

In size and colour this species closely resembles *L. minutus* Bl. The legs, however, hardly ever show any distinct annulation. The palpal organs and vulva are figured. Not rare in the South of England. Often found in outhouses and cellars.

Lepthyphantes subnigripes Cb.

Length. Female 3.5 mm.

The metatarsi and tibiae of the first, second, and fourth pairs of legs are brownish-black. Very rare.

Lepthyphantes nebulosus Sund. (*Linyphia vivax* Bl.)

Allied to *L. leprosus* Ohl., but considerably larger. Details of palpi and vulva are figured. This species is almost invariably found in outhouses, and appears to be somewhat local.

Lepthyphantes tenuis Bl. (*Linyphia tenuis* + *L. tenebricola* Bl.)

Length. Male 2.2 mm., female larger.

The palpus of this extremely common spider is figured. By an unfortunate oversight the names "falciform process" and "lateral stylum" are transposed in the inscription. The anterior central

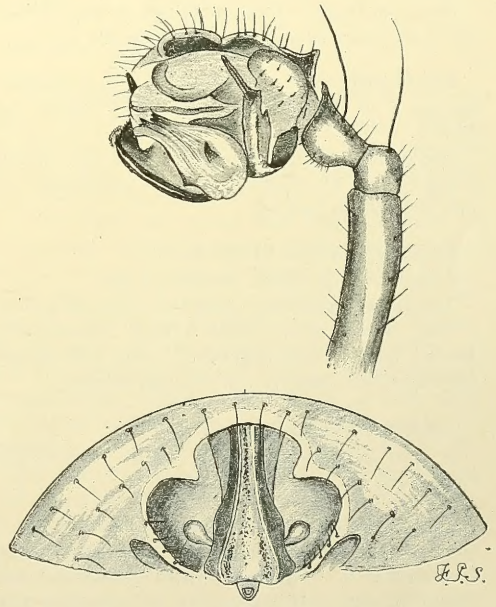


FIG. 2. *Lepthyphantes leprosus* Ohl. Palpus and vulva highly magnified.

eyes are slightly smaller than the laterals, and are almost one diameter apart.

Lepthyphantes blackwallii Kulcz. (*L. zebrinus* Menge.)

Very like *L. tenuis* in size and markings. The anterior central eyes are much smaller than the laterals, and are separated by only half the diameter of one of them. This species is fairly common.

Lepthyphantes terricola C. L. Koch. (*Linyphia alacris* Bl.)

Length. Male 2.5 mm., female larger.

Closely allied to *L. tenuis*. It is, however, larger, and the palpi and palpal organs are more prominent. The radial and cubital joints of the male palpus are each furnished with a long strong bristle. A rare species.

Lepthyphantes cristatus Menge. (*Linyphia cristata* + *L. relativa* [male] in "Spiders of Dorset.")

Length. Male 2.5 mm.

Closely allied to *L. terricola* C. L. Koch, but the radial and cubital joints of the male palpus lack the prominent bristles noted in that species. A rare spider.

Lepthyphantes obscurus Bl.

Length. Male 2 mm., female larger.

The digital joint of the male palpus has a strong curved horn-like process at its base. Rare.

Lepthyphantes whymperi F.O.P. Cb.

Length. Male 3.5 mm.

Abdomen black. Tibiae with two or more dorsal spines and some lateral spines. Extremely rare.

Lepthyphantes pallidus Cb. (*Linyphia pallida* + *L. relativa* [female] in "Spiders of Dorset.")

Abdomen pale dull yellow, almost always devoid of markings. The epigynum is very prominent. A rare and obscure species.

Lepthyphantes pinicola Sim.

Length. Male 2 mm., female 2.5 mm.

The palpal organs have upon their external surface a long curved spine, which projects considerably beyond them. The epigynum is long and sharply bent near its extremity. A very rare species.

Lepthyphantes cultus Cb.

A rare species described in "Proc. Dorset Field Club," vol. xiv. p. 152.

Lepthyphantes flavipes Bl.

I have never seen examples of this spider, which is described in "Spiders of Great Britain and Ireland," p. 247. It appears to be identical with *L. henricae* Kulcz.

Lepthyphantes inconspicua Cb.

Length. Male 1.5 mm.

The small size of this species will distinguish it from most of its allies. The distance between the posterior central eyes is much greater than that between one of them and the adjacent lateral. Very rare.

Lepthyphantes ericaeus Bl.

Length. Male 1.7 mm.

Closely allied to *L. inconspicua*, but the eyes of the posterior row are practically equidistant. Rare.

Lepthyphantes angulatus Cb.

This spider, of which only a portion of a specimen appears to exist, is described in "Spiders of Dorset," p. 519.

Lepthyphantes mengii Kulcz.

Described in "Proc. Dorset Field Club," vol. xvi. p. 111.

Lepthyphantes tenebricola Wid.

Described in "Proc. Dorset Field Club," vol. xvi. p. 111.

Lepthyphantes miser Cb. (*Linyphia turbatrix* in "Spiders of Dorset.")

This species and the next I include in this genus provisionally, having seen neither of them. Rev. O. P.-Cambridge considers them to be *Lepthyphantes*, but the descriptions would suggest that they were more nearly allied to *Po rhomma*, although distinct from this latter genus. Mr. F. O. P.-Cambridge, proposes for their reception a distinct genus *Hilhousia*, which may probably stand. In both species the base of the cephalo-thorax is strongly excavated. In *L. miser* the caput of the female is not raised to any extent. Extremely rare.

Lepthyphantes desolans F.O.P. Cb.

Length. Female 2.5 mm.

The caput is considerably raised and very convex. A very rare species.

(*To be continued.*)

COURTSHIP OF GHOST-MOTHS.

By H. M'Arthur.

YEARS ago, in my early collecting days, I was startled by my brother's exclamation, "A ghost! Be quiet!' I began to tremble, and wished myself at home. He made a short run, and soon had a large white moth in his net, and then explained to me that the reason for the male "ghost-moth" (*Hepialus humuli*) having its pendulum-like flight was that a female of its species was in the grass below, and the male in so flying would induce her to emerge from her hiding-place.

With that belief I was content for many years, until my first visit to the Shetland Islands, where, for some occult reason, the males of this species in many instances mimic the markings and colour of the females. I then put into practice what I had been taught in early boyhood and hunted amongst the grass for a female, over which the male was supposed to have been hovering. In each instance, however, I only found the empty pupa-case from which the male had emerged. One evening as I

was on the point of netting a male, a female collided with him, knocking the male on one side and herself falling to the ground. She immediately commenced crawling up the short grass stems, the male hovering lower and lower towards her, and in a very brief space of time the pairing was complete. I saw many others act in a similar manner, and in some of my former notes elsewhere, I have stated that the females collided with the males before pairing. Whilst in the Hebrides closer observation during the past season, however, convinces me that the collision is due to accident rather than design, the object of the female being to get immediately to the windward of the male. She then alights on the stems of grass below the male, and the pairing is soon effected. The males after emerging from the pupae never go more than a few yards from the place of pupation, though it may be a week or more before a female comes that way. On the evening following the pairing the male moth just gives one or two pendulum-like swings, and then flies away to any high point in his immediate neighbourhood, preferably to trees; or if there are not any, to a projecting rock, or even a chimney-pot on the top of a house. I think my observations tend to show that, in the habits of the ghost-moths, there is exhibited the unusual feature of the females searching for males during the pairing season. This is probably the correct solution for explaining the remarkable habit of flight in some species of the Hepialidae.

35 *Averill Street, Fulham Palace Road, London, W., October* 1901.

THE STRUCTURE OF PLANTS.

A CHAPTER IN ORGANIC EVOLUTION.

By Rudolf Beer.

(*Continued from page* 141.)

WE must in this article sift out the new conditions which are the concomitants of a terrestrial life, and so read the structure of the higher plants in changed environment.

The highest water plant that we have thus far studied was no more than a mass of cells all similar to one another. Such a mass of cells could assume various external shapes. The cells might be arranged as a long central axis corresponding to a stem, and upon this lateral organs, such as leaves, might be borne. This separation of stem and leaf is an arrangement through which the greatest amount of surface is spread out to the rays of sunlight; but we can return to this point later, when we will touch upon its importance to the plant.

An example of a plant of this kind will be found in Chara or Nitella, or, perhaps more correctly, in the probable ancestors of these already complex forms.

On land a plant of any size, with this configuration and structure, would collapse and huddle together the leaf-surface, which can only be of full use to the organism when it is expanded to the rays of light. One has only to remove from the water a plant of *Callitriche*, which is in this respect similar, although otherwise a far higher growth than the stage we are considering, to realise how impossible it would be for this plant to attain any size upon land, without at the same time losing a great deal of the efficiency of its leaf-surface. The manner in which this preliminary difficulty of a water plant becoming adapted to the conditions of the land was conquered was by the alteration of certain of its cells.

In the plant with its cells all alike these were thin-walled, round, square, or perhaps oblong structures. We had better at once learn to speak of such cells as parenchyma cells, and remember that they are the primitive form of cell-structure.

In the plant, struggling with the conditions of a terrestrial existence, certain of these parenchyma cells developed greatly thickened walls, and at the same time they became elongated in shape. It was the ring of cells lying just below the surface of the stem which underwent an alteration of this kind and gave rise to a cylinder of mechanical strengthening tissue. This stage is very well illustrated in the structure of the bog mosses or Sphagnums which carry on an amphibious life.

Every cell must contain a sufficient amount of water to maintain itself as a living object, and the greatest difficulty which undoubtedly confronted the earliest terrestrial forms was that of retaining this moisture in adequate amounts. The organism with a thin-walled cellular structure would rapidly lose its water by evaporation, and the only creature that could succeed under the new conditions would be one which had the walls of the outer cell-layer more or less impermeable to water. Such an impervious outer layer covering the surface of the most external cells like a skin may be found in all land plants of the present day. It is called the cuticle, and the outermost layer of cells of the plant which bears this cuticle is termed the epidermis. While the plants remained of small size this cuticle was amply sufficient for the purposes of water-retention, but as they grew larger

and the stem longer the danger of a too great loss of water constantly increased. The barriers of the cuticle would be gradually forced, and too much water lost in its passage through the stem to suffice for the needs of the growing apex. To meet this danger certain layers of cells lying beneath the surface underwent changes in the character of their cell-walls, similar to those we have seen in the cuticle, which rendered them, each and all, impermeable to water. Layers of cells that have become modified in this way are called cork, and, as is familiar to you, this tissue is removed from the plant and put to use in our daily life on account of its specific peculiarity. Being impervious to water, the cork cuts off any layers of cells which may happen to lie externally to it from the water that is essential to them and which is moving within the stem. Consequently these outer cell-layers die, and their dried remains, together with the cork, form the well-known bark of trees.

If the entire surface of the plant were enveloped in a coat through which moisture could not pass it would be difficult to see how many processes, important for the maintenance of plant life, could continue.

We find, however, that this water-tight casing of the plant is broken at two points: one below where the base of the plant, the root, buries itself in the moist earth; the other above at the opposite extremity of the plant.

The lower passage for water is, as we have said, the root. The particular spots of the root through which water is found to enter the plant from the usually damp soil are the root-hairs which cover the younger portions of that organ in abundance. The second channel for water above is furnished by the leaf-pores or stomata. Experiment shows us that water is leaving the plant from these organs. There is, therefore, a constant stream of water passing through the plant from below upwards. Along what channel and how does it travel? The second part of this question is to a great extent a dark and hidden mystery to us. That the force of evaporation through the stomata is largely concerned in the process we cannot doubt; but it is, by itself, insufficient to raise water to the great heights attained by several forest trees. Many attempts at an explanation have been made, but none are entirely satisfactory.

We are more certain with regard to the path taken by the water in its journey through the stem. In the earliest terrestrial forms the cells forming a central column running through the heart of the stem became greatly drawn out in length, while at the same time they retained their thin permeable walls. Along such a column of elongated cells water can travel easily and rapidly. We see a conducting column of this simple nature in the stems of the majority of the mosses.

As the struggle for life raged among the early plants this simple conducting arrangement was more and more elaborated. The thin-walled fibres which we see in the moss thickened their walls, without at the same time losing their permeability to water.

Moreover, to facilitate the passage of water from cell to cell a curious system of thin spots was left on the otherwise thickened wall. These thin areas on the wall are called "pits," and form a most characteristic feature on the conducting fibres. Beautiful representations of pitted fibres are to be found in ferns and in conifers.

In higher development still those walls which separate the cavities of fibres standing above one another in rows are absorbed, and long pipes or vessels are formed. In the higher plants we, therefore, find a system of pipes—miniature water-pipes—along which the water can move without hindrance of any kind.

It should be mentioned that both in the conducting fibres and in these vessels the living contents die and nothing remains that is functional in the mature plant except the skeleton of dead cell-walls. Any of the higher flowering plants, such as an oak-tree or a sunflower, will furnish examples of these vessels, and show us the delicately-pitted markings on their walls.

The green chlorophyll, which is so closely associated with the nutrition of the plant, can only carry on its functions when thoroughly illuminated. In the body of a plant, consisting of a mass of cells, it would be useless for chlorophyll to be developed in the innermost cells, as these are completely shaded by those lying outside. Any structure or organ that is useless to a living creature involves a waste of energy and material which would be fatal to the organism in its inevitable combat with its fellows, and very soon—that is to say, in a few thousand years—the needless structure would be eliminated. This explains the fact that "no single hair," as an old naturalist put it, "is without its definite use to the plant."

According to this "law," as we might almost call it, chlorophyll is only found on superficial areas of the plant, capable of illumination by the sunlight.

Thin laminae or plates of cells containing chlorophyll would form the most advantageous arrangement, in which each green cell would be assured of a sufficient supply of light, and in which at the same time there would be a considerable extent of surface working for the nutrition of the plant. This ideal mechanism is realised in the leaves of a plant. We have already seen that quite early in the history of evolution a differentiation of leaf and stem took place. The stem, we observe, is a structure to support and spread out the leaves. At first the stem was short and slender, but as vegetation increased on land, and suitable spots become thickly garmented with low growing herbs, the search for light became increasingly more

difficult. The foliage of one low plant would shade that of its neighbours, and the individual with the longest and most upright stem would receive the greatest amount of light, and in consequence would have a richer food supply and grow more vigorously than its fellows. Such long-stemmed plants would vanquish the shorter varieties when placed in open competition with them, and a race with long and rigid stems would tend to evolve. Events of this nature most probably underlie the history of our giant forest trees which raise their heads of leaves high into the air and light.

This enormous increase in the length of the stem would necessarily be associated with considerable internal anatomical modification. Mechanical strengthening tissue must be developed in far greater amount to support the great weight of leaves high above the earth; the root system must penetrate deeper and more firmly into the ground to prevent the overthrow of the lofty sub-aërial structure by every gust of wind, and this more extensive root system would furnish a far broader portal for the entrance of water into the plant. The water-conducting channels must be elaborated in response to this increased water supply and the longer path which must be traversed.

Moreover, the danger of evaporation from the surface would be greater in this far journey from root to leaf, and thicker layers of cork and bark would be necessitated. All these modifications we actually find in the tall trees which now and in the past have peopled our earth.

The manufacture of food is limited to the green cells, and these are practically all gathered together in the leaves. The food made in the leaves has to be distributed all over the plant, even down to the very tips of the roots. In the earlier plants we find the food in a state of solution either passing down the same conducting channel, up which water is moving, or taking a slow and laborious journey from cell to cell of the general parenchymatous tissue. In many ways such a course is an unsatisfactory one, and very early in the course of evolution we find a special conducting system for dissolved food-stuffs developing in the stem. Already in the higher mosses, such as the Polytrichaceae, we find such a food-carrying tissue, or bast, appearing. In the higher plants, and possibly even in the mosses, the bast consists chiefly of an aggregate of sieve-tubes. Sieve-tubes are long rows of cells, standing one above the other, in which the separating cross-walls have not completely broken down, as we found in the vessels, but are perforated by numerous tiny holes, giving them the appearance of a sieve. Associated with these sieve-tubes in the bast are also a considerable number of parenchymatous cells. The bast, as a rule, forms a mantle about the central water-conducting column, but this arrangement is liable to considerable alteration.

Up to the present we have spoken almost entirely of the individual elements which are active in carrying out the various functions of the plant, and have only incidentally used the word "tissue." Now we have to see that these elements, such as vessels, sieve-tubes, cork cells, etc., are not scattered anyhow through the plant without order or arrangement, but are severally gathered together in definite groups, which we may at once call tissues, and that these are distributed in the plant with the utmost symmetry and to the best advantage of the organism.

The primitive little-altered cells with which we started our considerations form the ground-work of the vegetable body in which the other tissues are arranged. This aggregate of living almost unaltered cells we have already called parenchyma. The vessels or conducting-fibres that convey the water are collected together, in company with a few living cells, as the wood. The food-conducting elements or sieve-tubes collectively compose the bast, which, as we have seen, usually forms a mantle outside the wood.

Between the wood and the bast there are often one or two layers of living actively dividing cells which constantly, throughout the life of the plant, add new elements to the bast on one side and the wood upon the other. This active formative tissue is called the cambium.

The most central features in the anatomy of the higher plants are the wood and the bast, which together form, primitively, a single central column running through the heart of the stem and the root. Modern anatomists call this strand by the Greek word for a column—namely, a stele.

The outermost boundary of this column or stele is very frequently marked by a peculiar and definite layer of cells called the endodermis, the functions of which are not properly understood as yet.

The column of conducting-tissue sends branches to each leaf, which carry water to, and food from, these organs. As the leaves become more and more numerous on the plant, branches are given off from the central stele with increasing frequency. A greater quantity of conducting-tissue is demanded, and the more superficially this could be arranged the easier would the entrance and exit of branches be rendered. In answer to this demand we find the originally solid column opening out into a broad cylinder or ring enclosing only parenchyma in the centre. This case of parenchyma is called the pith. As the surface of the cylinder of conducting-tissue broadens out still further, we find the sieve-tubes and the vessels forming themselves into little interrupted groups, still arranged in a ring between which parenchyma gradually creeps, forming the medullary rays running from the pith like spokes of a wheel. Many other changes in the form of the stele took place, as the development of the plant world proceeded, but we have not space to consider them in this paper. What I have attempted to make clear to you in this note is that

the vegetation of the earth, like all living Nature, is engaged, and always has been engaged, in life-long combat.

Food, light, and moisture are to a certain extent limited commodities under the conditions of life, and each organism fights with its neighbours for its supply. Every minute modification rendering more facile the attainment of these necessities will push forward the fortunate possessor to the detriment of its fellows.

A change no greater than the disruption of a microscopically small cellular cross-wall standing in the path of the water current would add to the nutrition of the plant and assist in the plant's struggle for life.

This constant warfare of the living world, acting through untold ages, is the key by which to read the structure of plants.

I have not been able to do more than touch lightly upon some few of the broader anatomical features, but in your own study of the structure of plants innumerable problems will constantly present themselves. I hope that I have been able to indicate the spirit in which you should approach these questions and the methods that ought to be adopted in seeking their solution.

Elmwood, Bickley, Kent.

BUTTERFLIES OF THE PALAEARCTIC REGION.

By Henry Charles Lang, M.D., M.R.C.S., L.R.C.P. Lond., F.E.S.

(*Continued from page* 170.)

GENUS *EUREMA* (*continued*).

E. hecabe (*continued*). Larva I.—IV. on *Aeschynomene sesban*. Other authorities quoted by Leech, p. 431, give Leguminosae and Madras Thorn.

2. **E. laeta** Boisd. Sp. gén. Lep., p. 674 (1836). 35–50 mm.

Wings amber-yellow, not so bright as in *E. hecabe*. F.w. have the base slightly powdered with black. Black border generally as broad as in *E. hecabe*, but without the square-shaped notch seen in that species; and it gradually enlarges in width towards the costa, and is slightly denticulated internally. Fringe reddish-yellow. Apices pointed. H.w. less rounded than in *E. hecabe*, without any markings on the wing area, but with a trace of a black border at external angle, and sometimes with a row of marginal black points. U.s. f.w. yellow, with costa and ou. marg. reddish. H.w. pale reddish.

Hab. S. Corea (Leech). XI., XII., III.—V. h.

a. var. *sub-fervens* Butl. Differs from type in the redder tone of the colouring of u.s., costa and apex of f.w. and the entire surface of h.w. being of a deeper colour than in the ♂ of *E. laeta*.

b. var. *bethesba* Janson. Cist. Entom. ii. p. 272 (1878). Differs from type in having the f.w. less pointed at apex. Wings pale lemon-yellow, colouring of u s. pale pinkish-white. ♀ smaller and paler yellow than ♂, "with the wings rather thickly speckled with black" (Janson). This is considered to be the summer dimorphic form of the species (*vide* Leech, p. 427), VII.—IX., occurring up to 9,000 feet altitude. There is no notice of these species in Staudinger's Catalogue, third edition. It is difficult to understand the omission, as they certainly occur in Corea.

Having now concluded the account of the family Pieridae, I here subjoin some extracts from the new edition of Staudinger's Catalogue of Palaearctic Lepidoptera, which involve additions or suggest alterations in respect of what I have set down in the present work. I shall not take any notice of names which are prefixed in the Catalogue by an *, as the forms so marked in that work do not properly belong to the Palaearctic Region.

Aporia hippia Brem. var. *thibetana* Gr.-Gr. Hor. xxvii. p. 127. *Tianschanica* R.H. smaller, h.w. more strongly ochreous beneath. Hab. Nan Schan. *A. kreitneri* Friv. is reckoned a var. of *hippia*.

Aporia dubernardi Oberth. var. *kozlovi* Alph. Mém. Rom. ix. p. 232, t. 2, f. 1. *? Aporia bieti* of this work.

Pieris brassicae L. *a.* Gen. vern. *Chariclea* Steph. ill i. p. 17. H.w. darker beneath. Hab. Azores. *b.* (Gen. aest. ?) *Catoleuca röber* Ent. Nach. 1896. Larger, with large black spots; h.w. whiter beneath. Hab. Asia Minor, Syria, etc. *c. wollastoni* Butl.; reckoned a var. of *P. brassicae*. *d. cheiranthi* Hb.; reckoned a var. of *P. brassicae*. *e.* var. *brassicoides* Stgr. The spring brood of Cent. Asia. H.w. very dark beneath, sprinkled with greenish-black. Hab. Fergana.

P. krueperi Stgr. Gen. vern. *devta* Nicev. Journ. As. Soc. 1883. H.w. grey and white beneath. Hab. Issyk Kul., Pamir, Ladak, etc. Var. *mahometana* Gr.-Gr. Wings with black margins above; u.s. much darker. Hab. Pamir.

(*To be continued.*)

The Homeland Handbooks.—We have on previous occasions referred to the excellent Homeland handbooks published by the Homeland Association, Limited, at St. Bride's House, 24 Bride Lane, Fleet Street, London. Before us we have two of the later guides, one being to the Devonshire town of Teignmouth, by Beatrix F. Cresswell, and the other, by Stanley Martin, being a second edition of "A Glimpse of Cranbrook, the Town of the Kentish Weald." Both are picturesquely illustrated, and contain references to geology, plants, and other objects of Nature. The price is only 6d. per volume, and these books are well worth the expenditure of so small a sum.

BRITISH LEPIDOPTEROLOGY.

IT will be remembered that some time ago we noticed Mr. J. W. Tutt's first volume of "A Natural History of British Lepidoptera" (SCIENCE-GOSSIP, N.S., vol. vi., p. 275). In that volume the author divided his subject into two parts, the first dealing with "The Origin of the Lepidoptera," "The Ovum," "Embryology," "Parthenogenesis," "Structure of the Lepidopterous Larva," "Variations of the Imagines of Lepidoptera," "Protective Coloration and Defensive Structures of the Larvae," and "Classification." In the second part was considered "The Sphingo-Micropterygid Stirps: Sub-families I., II., III., and IV.," "The Micropterygides," "The Nepticulides," "The Cochlidides," and "The Anthrocerides." The whole volume formed a most valuable treatise, so far as it went, on the order Lepidoptera, although primarily intended for British students. We received in due course the second volume of this work (1), and regret that various events have delayed an earlier notice of so important a book.

Following the plan adopted in Vol. I., Mr. Tutt again divided the subjects in the second volume into two parts. The first is occupied by chapters on "The Metamorphosis in Lepidoptera," "Incidental Phenomena relating to Metamorphosis," "External and Internal Morphology of the Pupa," and "The Phylogeny of the Pupa." The second section is occupied by a continuation of the Sphingo-Micropterygid Stirps, the Sub-family V. Psychides, and commencement of Sub-family VI., Lachneides, occupying the rest of the volume.

There cannot be any doubt as to the amount of hard conscientious work put into this second volume by the author. The result is that the promise indicated in the first volume has been more than fulfilled towards forming a really fine book on the British Lepidoptera. Of course, treated as has been the subject by the author, these two volumes by no means exhaust it, and we must expect much more from his pen before an end comes to his labours in this direction. Whilst contemplating the author's task, what he has already done towards it, and the comparatively small leisure he has for this purpose, we are arrested by admiration, if not amazement, at his perseverance and dogged pertinacity. Added to these qualities, so necessary to the successful author, is that of originality, the valuable faculty of arranging the work of others, and with his own, weaving a plan independently of previous writers. Such deviation from the beaten track is never popular with the older students of any subject, and especially is this so among the lepidopterologists, the most conservative of naturalists. Yet, in face of all opposition, Mr. Tutt has slowly won for himself the respect deserved by his work; and, if not the whole of his audience are disciples, he has awakened among them a wider, more scientific mode of thought and study than has hitherto obtained among them. We all know for how long the term "lepidopterist" was but a synonym for collector, and how readily the more exact students in some other branches of science sneered at them for "moth-catchers." This is now passed, as there has arisen a numerous body of scientific lepidopterologists, of which the author of the volumes before us is the type. They will engender in the rising generation of students of this order, an entirely new system of work, as they realise that identification and arrangement in cabinet drawers is but the smallest part of the duties of a good entomologist.

The first portion of each of the two volumes issued of Mr. Tutt's work on British lepidoptera forms an elaborate natural history of earlier stages of the order until we reach the pupa, which is most fully and scientifically considered. Any student following these chapters with thoroughness will have a liberal education upon insect metamorphosis. In addition he will meet with comparative points, indicating the value of this knowledge, when studying the question of evolution of animals in the wider sense.

With regard to the second portion of the volumes, the old arrangement and consideration of the lepidoptera have gone, and gone, we suspect, for ever. Whether Mr. Tutt's views are wholly accepted or not, he shows that with the present wider knowledge of the order in the embryonic stages the old classification, founded on the morphology of the perfect insects, is impossible. Therefore the reader who will obtain this work must expect to be "shocked," if he be an old collector; but the shocking should be for his benefit.

In his treatment of Sub-family V., the Psychides, we have by far the most comprehensive monograph on them yet written in the English language. Again, repeating our previous statement, the amount of good work done by Mr. Tutt in the 330 pages devoted to the Psychides is astonishing. It is very pleasing to find the amount of support he has received from all parts of the continents of Europe and America, friends and strangers alike placing most valuable information at his service. We have thus before us an unravelling of a most complicated subject. Here, again, will be found a rearrangement of facts of the utmost value in the study of evolution at large. This work is indispensable to all lepidopterists.

JOHN T. CARRINGTON.

(1) *A Natural History of the British Lepidoptera.* A text-book for students and collectors. By J. W. Tutt, F.E.S. Vols. I. (January 1899) and II. (May 1900). London: Sonnenschein.

NEW BRITISH TICKS.

By E. G. Wheler.

THE following additions may be made to the list of British ticks lately recorded in Science-Gossip (*ante*, p. 103).

IXODES TENUIROSTRIS Neumann.

Male. Length 1.83 mm. Light brown, margin lighter, nearly white. Capitulum slightly distended laterally. Palpi wide apart at the base, though in less degree than in the female. Coxae of all legs without spines or tubercles. Apparent sexual orifice opposite the space between the second and third pairs of legs. Ventral shield large. Tarsi short and truncate. Labium and palpi very short and wide.

Ixodes tenuirostris. Male.

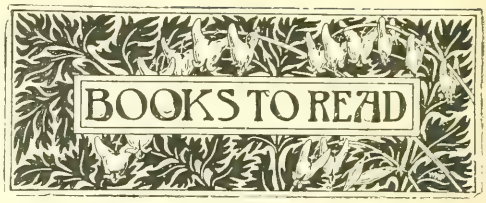
The male of this species has not hitherto been described. I am indebted to Mr. Pocock, of the British Museum, for kindly lending me a specimen preserved in spirits, recently taken from a long-tailed vole (*Arvicola pratensis*) near Swansea. The species occurs on the short-tailed vole, *A. agrestis*, and doubtfully on the water vole.

As it has now been taken in Gloucestershire, Northumberland, and in South Wales, it must be widely distributed, and will probably prove to be by no means uncommon. It appears to confine its attacks entirely to the voles. This species is the most minute of the British ticks. It resembles *I. hexagonus* in general appearance, but is much smaller, and can be at once recognised by the greater width between the palpi at their base than at their extremities, which touch, and thus give the idea of grasping, the labium.

IXODES PUTUS Cambridge.

Mr. Pocock has taken a number of females of this species from a dead puffin at Morthoe, in North Devon. This is its second occurrence in England. The male is as yet unknown. The characteristic shape of the dorsal shield, which is well shown in the figure of the nymph, *ante* p. 71, is the chief distinguishing feature of the female.

Swansfield House, Alnwick.



NOTICES BY JOHN T. CARRINGTON.

Zoology: an Elementary Text-book. By A. E. Shipley, M.A., and E. W. MacBride, M.A., D.Sc. xxi + 632 pp., 9 in. × 6 in., with 349 illustrations. (Cambridge: The University Press. 1901.) 10s. 6d.

This is a volume in the "Biological Series of Cambridge Natural Science Manuals," of which Mr. Arthur E. Shipley, M.A., is the general editor, as well as joint author of the work before us. We understand that this is to be considered as an elementary treatise on zoology, in which the technical terms are explained as they occur, and in many cases their derivations are given, so as to help the beginner. The plan aimed at in producing this book is one of progression, so that the reader will find it necessary to begin at the commencement and study the sequence, by which means he will be led to a general knowledge of the normal structure of recent animals in the adult form. Wherever possible the student is shown how that form has been the outcome of functional habit. In this connection some reference is made to embryology and palaeozoology. The animals chosen as representatives are generally members of the British and North American faunas. Although written in a popular manner, this work is really founded on the most modern scientific teaching, the latest terminology being adopted throughout. It is very liberally illustrated, which cannot fail to be helpful to those who may rightly take the work as a standard manual on the subject. Although to some extent a text-book, it is far above those which are used only for cramming young students to pass examinations, being one that will be valuable for reference in later years.

Lectures and Essays. By the late William Kingdom Clifford, F.R.S. Edited by Leslie Stephen and Sir Frederick Pollock. 751 pp., $7\frac{1}{4}$ in. × $4\frac{3}{4}$ in. In two vols., with portrait. (London: Macmillan & Co. 1901.) 10s.

Already two editions of these essays have appeared, and a third is a further indication of their popularity. They are indeed the charming work of a delightful man, to know whom was a privilege. In the hands of two such able editors this edition should become a standard work on the shelves not only of the man of science, but also of the general reader.

A Catalogue of the Lepidoptera of Ireland. By W. F. De Vismes Kane. xvi + 166 pp., $8\frac{1}{2}$ in. × $5\frac{1}{2}$ in., with coloured plate. (London: West, Newman & Co. 1901.) 10s.

Readers of the "Entomologist" have for some time past been familiar with articles on the lepidopterous fauna in Ireland. These have now been arranged and published in complete form, embellished with a coloured plate, showing some of the local forms so peculiar to that country. The list is prefaced with an introduction that will be found of much use, both from the historical and biological points of view.

Photography for Naturalists. By DOUGLAS ENGLISH. viii + 132 pp., 9½ in. × 8 in., with 56 illustrations. (London: Iliffe & Sons, Limited. 1901.) 5s. net.

The author of this book strongly advocates photography as an illustrator in scientific works, rather than the art of the draughtsman. In a descriptive treatise on certain objects of Nature such as he portrays, where the illustrations are made in the open country, he abundantly proves his case. The primary object of Mr. English appears to be the cultivation of the art of photography to aid naturalists in making observations. He therefore gives a series of instructions which will be helpful. In addition to the chief illustrations of the work there are diagrams showing the position of the camera and other arrangements to attain successful photography. As a rule the instances illustrating the author's own work are good. We present to our readers, by permission of the publishers, one of an aquarium with sticklebacks. Mr. English's photographs of fish are successful, as indeed is the rest of his book, which is handsomely illustrated: an interesting addition being some plates representing the haunts of British fauna. This work should give an impetus to the wider use of photography among field naturalists.

STICKLEBACKS.

(*From "Photography for Naturalists."*)

Progress of the Zoological Society of London. Edited by the SECRETARY. vi + 248 pp., 8½ in. × 5½ in., illustrated with plans. (London: The Society. 1901.)

From the preface we learn that the Council determined at the close of the last century to elect a sub-committee of the Publication Committee, with the object of preparing an official statement regarding the Society's past. This committee—consisting of Professor G. B. Howes, F.R.S., Dr. A. Smith Woodward, F.R.S., the Secretary, and the Vice-Secretary—have issued their Report, which is entitled "A Record of the Progress of the Zoological Society of London during the Nineteenth Century," with a copy of which we have been favoured. It must not be thought from this voluminous title that the book before us is equally verbose. As a matter of fact, the volume errs, if in anything, in the parts that are really interesting to the general reader, in its excessive conciseness. There is seldom more than from half a page to a page and a half devoted to the progress of any of the years. This will be understood when we mention that the first 144 pages out of the 248 constituting the book are devoted to the printing of the charter, bye-laws, list of Fellows, members, and the permanent staff at the end of 1900. The remainder of the volume possesses more than general interest to the reader, and one can only wish that the committee had seen its way to greatly enlarge this section of the volume. To those zoologists who read the pages before us, it will be disappointing to find so little indicating what might be called the early history and struggles of those enthusiasts who founded what has now become such an important institution. Perhaps this may be accounted for by reference to a paragraph in the preface signed by Mr. P. G. Sclater, the Secretary. Therein he states that Mr. Henry Scherren has been engaged in making researches on the early history of the Society, from which, it appears, the extracts have been taken that in the volume before us are entitled "A Short History of the Zoological Society of London." It may be that the committee who had charge of the matter felt they should not prejudice a future publication founded on Mr. Scherren's labours. Be that as it may, the result before us is disappointing in its brevity. Still, there is much of great interest in this story of the Zoo, and some sentences that are amusing. For instance, we find in 1826 that "a Wanderoo monkey snatched the wig from the head of a bishop and put it on his own." We note that Dr. Sclater has been secretary to the Society since the annual meeting in 1859.

Use-Inheritance. By WALTER KIDD, M.D., F.Z.S. 47 pp., 8½ in. × 5½ in., with 16 woodcuts. (London: A. & C. Black. 1901.) 2s. 6d. net.

Dr. Kidd has been studying the formation of "Whorls in the Hairy Coats of Mammals" and

"The Slope of Hair on the Bodies of Animals," which are the titles of the two chapters forming the book. The author's object has been to show that characters in domesticated and other animals are inherited, a theory which is now generally accepted. The book, however, contains a considerable amount of interesting reading, and the illustrations are bold and suggestive.

Elements of Modern Chemistry. By CHARLES ADOLPHE WURTZ. Sixth edition. 808 pp., 7¾ in. × 5 in., with 136 figures. (London: J. B. Lippincott Co. 1901.) 10s. 6d.

The sixth edition of this well-known work has been revised and enlarged by Drs. William H. Greene and Harry F. Keller. There have been several additions, as well as corrections, rendered necessary by the rapid advance of the science. There is also a new chart, showing the spectra of gaseous elements and metals. This chart is in colours.

The Country Month by Month. By J. A. OWEN and G. S. BOULGER, F.L.S., F.G.S. viii + 492 pp., 8¾ in. × 6 in. (London: Duckworth. 1902.) 6s. net.

It will be recollected that some few years ago this work appeared in parts, representing the months to which they referred. It is now reissued in volume form, with copious notes by the late Lord Lilford. These additions are a considerable improvement to the already pleasantly chatty pages that are devoted to country lore. They do not pretend in any way to scientific aspirations, but to the lover of the country they will form pleasant reading.

Fauna, Flora, and Geology of the Clyde Area. Edited by G. F. SCOTT ELLIOT, MALCOLM LAURIE, and J. BARCLAY MURDOCH. x + 567 pp., with coloured map. (Glasgow: University Press. 1901.)

This work has been issued by the local committee for the meeting of the British Association, 1901, and is the result of a number of papers by various authors dealing with the subjects included in the title. Although, naturally, chiefly of local interest, the work, which appears in most instances to have been carefully compiled, may be found useful for reference by students of the respective subjects. The lists themselves are purely such, but in some instances there are introductory notes that form more interesting reading. There is not any price given with the work.

The Writings of Oliver Ormerod. ix + 351 pp., 8 in. × 5 in., with portraits and other illustrations. (Rochdale: James Clegg. 1901.) 5s. net.

Rochdale has always been celebrated for its cultivation of the Lancashire dialect. Among the writers, one remembers such names as those of John Collier—otherwise "Tim Bobbin"—Oliver Ormerod "O. Felley fro Rachde," Edwin Waugh, John Trafford Clegg, Margaret Rebecca Lahee, John Byrom, Samuel Laycock, and Ben Brierley. Modern education has little in common with dialects, which are being gradually swept away before the tendency to a more general uniformity of speech throughout the country. They will, however, in some localities still linger for many generations, but with lessened richness as each passes away. Therefore all works on dialectic folklore have their value as giving an idea of a local popular language of the past. The book under notice is a collection of the writings of Ormerod about the middle of the nineteenth century, and will be found of value to the student of dialects, but to the uninitiated almost as difficult to read as a foreign language. A single work such as this should not be taken as an exact type, for where there is no recognised spelling of dialects each writer forms his own, hence the need of comparison. It would be well if some of the societies, local or otherwise, were to obtain, before it is too late, a series of "phonograms" of dialects for the edification of students in future centuries.

Practical Science. By J. H. LEONARD, B.Sc. Lond. xii + 138 pp., 7 in. × 4½ in., with 13 figures. (London: John Murray. 1901.) 1s. 6d.

The full title of this useful little work is "A First Course of Practical Science, with Full Directions for Experiments and Numerous Exercises." There is a short preface by Dr. J. H. Gladstone, F.R.S., recommending the style adopted by the author, which is stated to be the outcome of some years of practical experience in science teaching. This little work is one of Mr. Murray's "Home and School Library," which in itself is a guarantee for its scholastic value.

To-day with Nature. By E. KAY ROBINSON. xii + 338 pp., 7½ in. × 5 in. (London: Grant Richards. 1901.) 6s.

Mr. E. Kay Robinson has a facile pen, and portrays incidents in Nature with much brightness and originality. He does not pretend in any way to severe science; but among his pleasant gossipings one constantly comes across suggestions that create food for scientific thought. Not that he is always correct in his statements, being rather inclined to accept the popular explanation of phenomena, especially when sufficiently picturesque, which makes his style even more pleasant reading. In this book the writer follows the calendar, commencing with January, and has words for the year round. They are chiefly short notes, jotted in the passing moment and of passing thoughts. This is a pleasant book to take in hand for short readings and distraction.

Strange Adventures in Dicky-Bird Land. By R. KEARTON, F.Z.S. xii + 195 pp., 8 in. × 5½ in., with illustrations by CHERRY KEARTON. (London, Paris, New York and Melbourne: Cassell & Co., Limited. 1901.) 5s.

There will be few more attractive books issued this Christmas-time for boys and girls than this collection of stories "overheard" by the author. They are stirring anecdotes of what might happen any day in bird-land, and will make the young people for whom they are written take a keen interest in the dicky-birds they see, after reading Mr. Kearton's blood-curdling accounts. The pages are beautifully illustrated by the talented brother of the author, whose photographs are so well known to our readers. They represent wild birds and other animals at home, pictures won only by patience and with a love for woodcraft or country lore, that enters into most of them, causing their remarkable naturalness.

The Tutorial History of English Literature. By A. J. WYATT, M.A. Lond. and Camb. Second edition. xii + 223 pp., 7 in. × 5 in. (London: W. B. Clive. 1901.) 2s. 6d.

This primer of English literature is one of the best with which we have met, and is interestingly arranged. Considering how fragmentary and incomplete are text-books at their best, we find less fault with this than with most. This was only to be expected from Mr. Wyatt.

WE have received the twelfth catalogue of the Natural History Library of M. Alphonse Milne-Edwards, which is to be sold in Paris by public auction from the 16th to the 21st of this month.

A LINNET'S nest containing four eggs is said to have been found recently in Suffolk. The nest was probably that of a pair of this year's birds who had mistaken the mildness of the autumn for an early spring.

EXPERIMENTS with Signor Bacelli's treatment of foot-and-mouth disease continue to be made, and up to the present have met with complete success. It is noteworthy that the Japanese Government has asked for full particulars of this treatment.

THE Zoological Society have issued with the list of Fellows an interesting summary of about one hundred pages of the history of the Society from its foundation and the development of the Gardens. This appears to be a new departure in the literature of learned bodies.

AMONG the recipients of birthday honours we congratulate Sir George Anderson Critchett, on whom King Edward has conferred the honour of knighthood. Sir G. A. Critchett is oculist to his Majesty and President of the Ophthalmological Society of London.

THE village of Stavrova, in the Ananieff District of South Russia, was recently the scene of an interesting discovery. The skeleton of a huge animal was found in a neighbouring ravine, and, from the shape of a tooth, is thought to be that of a mastodon or sivatherium. The tooth, lower jaw-bone, and the bones of the extremities have been placed in the Archaeological Museum at Kherson.

A MAP of America, said to be one of the earliest known, has been discovered in the library of Wolfegg Castle, which belongs to Prince von Waldburg-Wolfegg. The map was drawn in 1507 by Martin Waldsee Müller, who is supposed to have given America its name after the explorer Amerigo Vespucci. An evening paper reports this discovery under the heading "An Early Map of the U.S." It would, indeed, be a very early map, seeing that the United States of America were not in existence for some centuries later.

THE young male zebra recently presented by the Negus Menelik to King Edward VII. has been identified as *Equus granti*, a form allied to *Equus burchelli*. Another interesting arrival at the Gardens is a young specimen of the black-crested langur (*Semnopitheeus melanolophus*) from Sumatra. This animal, though known to science for the past eighty years, has never before been exhibited. The "eagle" that was said to have attacked a workman at Westminster in October was sent to the Gardens and placed in an aviary behind the Camel House. The bird, a female gos-hawk, probably escaped from captivity.

WE HAVE received a reprint of a Paper by Mr. J. J. Wilkinson, "On the Pharynx of *Eristalis* Larva." There are several illustrations showing the anatomical arrangement of the muscles.

PROFESSOR J. A. FLEMING will deliver the Christmas course of lectures to young people this year at the Royal Institution. The subject will be "Waves and Ripples in Water, Air, and Ether."

PREPARATIONS are being made for the despatch of a new Norwegian expedition to determine more exactly the position of the North Magnetic Pole. The expedition will be directed by M. Amundsen, one of the officers in M. Gerlache's Antarctic Expedition.

M. SANTOS-DUMONT is to be congratulated on being awarded the Deutsch prize. He has become a member of the Aëro Club of the United Kingdom, which has been registered lately as a limited liability company, and is now staying in London with a view to further experiments.

MR. CECIL BARKER, from the Veterinary Committee, reports that the Society's experiments on the possibility of infecting bovine animals with tuberculous material from the human subject has been in progress for over three months. We await with great interest the publication of the results of these experiments.

PROFESSOR PAUL EHRLICH, of Frankfort-on-Main, has been enabled to devote himself to the special study of the disease of cancer in consequence of a bequest of 500,000 marks dedicated to this purpose by the late Herr Theodore Stern. Other donations have raised this amount by 40,000 marks (£2,000) a year.

A STUDENTS' hall of residence in connection with the Liverpool School of Tropical Medicine was opened on November 2nd. The object of the promoters of this institution is to provide a temporary home for Colonials who come to study at the School of Tropical Medicine. Already five students are in residence at the new hall, which is situated in Upper Parliament Street, Liverpool.

MADAME CHRISTENSEN, the fasting woman at the Royal Aquarium, recently completed her thirty-five days' fast without any appreciable detriment to health other than the loss of 27½ lbs. in weight. Without entering upon the question of the possibility of fraud in such cases, there is no doubt a certain scientific value attached to these experiments, inasmuch as they show that miners and others imprisoned without food, but with water, may support life for a prolonged period, provided there is no physical exertion to rapidly destroy muscular and nerve tissues.

DR. WILLIAM SAUNDERS recently issued a report upon the hybridising of various forms of apples in view of establishing a fruit that will prove hardy in the North-west of Canada. Hitherto no variety has been found which would stand the intense cold of the Central North-west Provinces, where a minimum temperature of 60° below zero Fahr. is not infrequent. Professor Saunders has experimented with some success on a hybrid of *Pyrus baccata*, a species of wild crab apple native to N. Siberia, and some Canadian hardy forms, the result being the production of a fruit that bears an abundance of small apples of fairly good flavour, which have become easily acclimatised in the North-west Provinces.

Mr. Francis Y. Edgeworth, M.A., Fellow of All Souls' College, Oxford University, has been re-elected to the Drummond Professorship of Political Economy.

M. Draps-Doms, Vice-President of the Royal Linnean Society of Brussels, has just received the Cross of a Chevalier of the Order of Leopold. This gentleman is a horticulturist at Laaken.

The Minister of Education for Ontario has issued the Archaeological Report, containing an interesting article upon the human form in Indian art. Many of the illustrations are curious and suggestive.

We have received a prospectus of the "Subject Matter Index of Mining and Metallurgical Literature for the year 1900," which is shortly to be published. The Index appears to be of a very comprehensive character, and should prove useful.

In the Transactions of the English Arboricultural Society last issued is a report of the 19th annual meeting held in Manchester. It is embellished by photographs, including views taken in Dunham Park and at Chatsworth. There is also a useful article on the management of Delamere Forest in Cheshire.

Messrs. Sanders & Crowhurst, 71 Shaftesbury Avenue, are issuing lantern slides, for lecture purposes or private use, made from negatives of the photographic illustrations in Mr. Oliver Pike's "In Birdland." The slides exhibit some pleasing pictures of birds, nests, eggs, and young, in a state of nature. The firm has also a new series of slides of living animals.

The Executive Committee of the "Yorkshire Naturalists' Union" invite subscriptions for the work, which has for some time past been in preparation, on "The Birds of Yorkshire," commenced by Mr. W. Eagle Clarke and continued by Mr. Thomas H. Nelson. It includes selections from the whole of the MSS. of the late John Cordeaux. The price will be one guinea, and the subscription is payable to the Honorary Secretaries, 259 Hyde Park Road, Leeds.

The Field Columbian Museum publications to hand include Nos. 55, "The Oraibi Loyal Ceremony," by G. A. Dorsey and H. R. Voth; 56, "Archaeological Investigations on the Island of La Plata, Ecuador," by G. A. Dorsey; 57, "A List of Land and Sea Mammals of North America," by D. G. Eliot; 54 and 58, "Mammals obtained by Thaddeus Surber in the Provinces of New Brunswick and Quebec in Canada, and the States of North and South Carolina, Georgia, and Florida." They are beautifully illustrated, and of much value to the students of the various subjects with which they are concerned.

Geologists who contemplate visiting the Antrim coast will be glad to hear that, through the enterprise of the Northern Counties Railway Company of Ireland, their explorations will in future be greatly facilitated. With much judgment and complete avoidance of destruction of natural beauty, a path has been taken around "The Gobbins," a bold and wild series of rocky cliffs in the district of Islandmagee, between Carrickfergus and Larne. It is intended to carry this path still further. Mr. R. Welch, the well-known photographer of Belfast, himself an enthusiastic naturalist, has issued some new photographs of the district.

In the latest received "Proceedings" of the Royal Society of Queensland are several articles of more than local interest, including a monograph on a malaria-carrying mosquito (*Anopheles pictus*).

The London and Provincial Ornithological Society this year provided an additional item of interest at its sixteenth annual show of canaries, foreign birds, and their hybrids, at the Crystal Palace, in a singularly fine collection of stuffed specimens both of British and foreign birds.

At a recent meeting of the Entomological Society Mr. F. B. Jennings exhibited a beetle (*Trachyphlacus myrmecaphilus*) taken at Hastings, remarkable in that the deciduous mandibles of the pupal stage were retained in the perfect insect, which consequently had two pairs of mandibles.

Mr. Charles A. Snazelle is now established in North London as a vendor of scientific books and objects. Among the latter he holds an agency for microscopic and lantern slides prepared by J. Hornell, of Jersey, which will be convenient to residents in the neighbourhood. His address is 4 Tollington Park, N.

The memorial to Sir Joseph Bazalgette, the eminent engineer, which has been erected on the face of one of the pylons of the Victoria Embankment opposite Northumberland Avenue, was unveiled on November 6th by Mr. A. M. Torrance. The memorial contains a portrait bust in bronze of the deceased engineer.

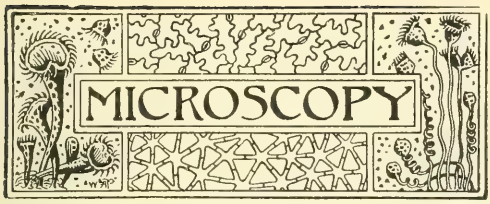
A short time ago we were favoured by the Maryland Geological Survey with an atlas and beautifully illustrated account of the geology of Allegany County. The illustrated article on the hydrography of its rivers is one of the more important, as it explains the manner of ascertaining the speed and volume of the flowing water.

Our readers will learn with interest that in the last week of November the copyright of Charles Darwin's "Origin of Species" expired. To commemorate this event Mr. John Murray has just issued the complete work, of over 1,000 pages and portrait of the author, bound in stiff paper, at the extraordinarily low price of one shilling.

The Division of Entomology in the U.S.A. Department of Agriculture has issued a valuable volume upon "some insects injurious to the rose, violet, and other ornamental plants." This work should be useful to those interested in their growth in Europe, as remedies are given, which might be applied with success on this side of the Atlantic.

We have received a supplementary catalogue of lantern slides issued by Newton & Co., of Fleet Street, London. There are many of scientific interest, some being by recognised specialists, such as Dr. H. R. D. Spitta, Dr. J. Leon Williams, Professor R. W. Wood, and others. These slides will be useful for winter lecture purposes, as they represent widely different subjects.

Scientific students visiting the geological department of the British Museum will miss the influence of Dr. Henry Woodward, F.R.S., the Keeper of Geology since 1880, who, we understand, has completed his duties in the public service. His term has been previously twice extended beyond the usual age limit, his being one of those cases in which strict enforcement of the usual enactment is detrimental to the general welfare of the scientific public.



CONDUCTED BY F. SHILLINGTON SCALES, F.R.M.S.

Royal Microscopical Society, October 16th.—Wm. Carruthers, Esq., F.R.S., President, in the chair. Mr. C. Baker exhibited a portable microscope on the model of the "Diagnostic," originally designed for Major Ronald Ross's investigation of malaria. It is made of magnalium, an alloy of manganese and aluminium, and weighs but 14 ounces. This firm also exhibited a microscope intended for the examination of fractures and etched surfaces of metals. It is provided with vertical illuminator, and rack-and-pinion focussing adjustment and levelling screws to the mechanical stage now usual in this class of instrument. Messrs. R. & J. Beck exhibited a portable model of their "London" microscope, which is a very substantial instrument, and is, by the introduction of several ingenious devices, made to pack with the apparatus into a leather case 2¼ in. × 4½ in. × 9⅝ in. Messrs. Beck also exhibited a centrifuge made to run at a high speed by an electric current. The Secretary announced that a letter had been received from Sir Dighton Probyn intimating the pleasure of the King to continue his patronage of the Society. The President brought to the meeting some specimens of the Mycetozoa, and gave a brief account of the life history of this group of organisms. The specimens belonged to a recently described species, and had been named *Badhamia foliicola*, and he had brought for distribution among the Fellows some leaves and grass on which were spores. The President called attention to the exhibits by Mr. C. L. Curties, consisting of a number of mounted specimens of marine zoological objects, accompanied by very full and interesting descriptions. The President gave a résumé of a paper by Miss A. Lorrain Smith on "Fungi found on Germinating Farm Seeds." Miss Smith had been assisting him in his work for the Royal Agricultural Society in examining farm seeds in respect to their germinating power. In the course of their observations Miss Smith had found numerous species of fungi on the germinating seeds—fourteen species in all, of which five were new, and one belonged to a new genus. The paper would be printed in the Society's journal. The Secretary announced the receipt of part xiv. of Mr. Millett's report on the foraminifera of the Malay Archipelago, which was taken as read. He also said that the Hon. Thomas Kirkman had sent some of the fine quills of the porcupine for distribution among the Fellows, who would find them very useful in mounting minute objects. Mr. C. Beck read a letter from Mr. Gordon in reference to a portion of his paper on the Abbé diffraction theory, and in correction of the remarks therein made.

Quekett Microscopical Club.—The 389th ordinary meeting of the club and first of Session 1901–1902 was held on Friday evening, October 18th, at 20 Hanover Square, W., Mr. J. G. Walker, F.S.A., Vice-President, in the chair. New members were balloted for. The Secretary read a list of books and periodicals added to the library since the last meeting. The additions to the cabinet were announced and acknowledged. These last included some slides of plague bacillus found or cultivated under various conditions, mounted and presented by Mr. Pound, of the Stock Institute at Brisbane. Mr. Scourfield read a paper by Mr. A. Ashe on "Two-speed Fine Adjustments." This was a description of several forms of fine adjustment, having two milled heads rotating on the same axis, by which a medium or an extremely slow movement could be obtained at will. Some new forms of "differential screw" movement were employed to this end. The method recommended for the Continental form of microscope had been arrived at independently and put into practice by Herr Reichert of Vienna. Another form which was exhibited was employed, at the author's suggestion, by Messrs. Beck. Mr. Scourfield read a paper on "Hydra and the Surface Film of Water," and showed, by means of an ingenious model and by drawings on the blackboard, how minute objects, though slightly heavier than water, could remain in contact with its surface. This result was obtained by means of a waxy or water-repellent substance coming into contact with the surface film and forming a capillary depression. The author pointed out how many aquatic creatures, though undoubtedly heavier than water, could yet remain at the surface without the aid of movement or air-bubbles. The *Hydra* holds to the surface by its basal disc, and the author had been able to see a number of hyaline strands which were apparently secreted from the disc. The strands, though difficult to discern, were seen to extend considerably, thus making a "capillary depression" of comparatively large area. The author believes that this stringy secretion, intermixed as it is with globular and ovoid bodies, is formed by the breaking-up of the ectodermal cells of the basal disc. In the ensuing discussion Mr. Karop described an analogous secretion in the Gregarines. Mr. Morland gave instances of the unexpected stresses the film of water will bear. Mr. Rousselet read a paper on "*Triarthra brachiata*, n. sp." This was an account of a new species of rotifer, and a specimen was exhibited under a microscope. In the ensuing discussion, in reply to a question by Mr. Scourfield, Mr. Rousselet said that he had not met with an instance of a rotifer making use of the surface film in the way that did the *Hydra* and some *Cladocera* in fact, the surface film was a death-trap to rotifers. Rotifers provided with long spines, like Triarthra and many others, were at a disadvantage in that respect. Mr. A. A. Merlin's paper "On the Spermatozoon of the Rat" was held over for the next meeting. Formal proceedings then terminated. At the conversazione many objects were exhibited, including a model to show the support of the surface-film of water, exhibited by Mr. Scourfield. This was a piece of match weighted with a pin at one end sufficiently to make the match sink; the light end of the match was smeared with vaseline. On bringing the match from below to the surface of the water it hung supported from the "surface film." Messrs. R. & J. Beck, Limited, exhibited a "Pathological" microscope with Mr. Ashe's two-speed fine adjustment, and Mr. R. T. Lewis exhibited a slide showing the "Sense-organ on the palpus of male Anopheles.'

This was a curious projection on the extremity of the palpus, free to move in all directions, even inwards. It is not found on the common gnat, but is seen on the palpi of ticks. Coloured drawings were also shown. Mr. Rousselet exhibited a slide of *Lophopus crystallinus*, beautifully mounted by himself, and Mr. Earland exhibited a slide showing trifurcate sponge spicules.

Manchester Microscopical Society.—The monthly meeting of this Society was held on Thursday evening, November 7th, at the Grand Hotel, Manchester. Mr. Mark L. Sykes, F.R.M.S., read a paper on "Evolution in Butterfly Scales." Mr. Sykes said that he had selected for the purposes of his communication some of the specimens illustrated in his paper on "Natural Selection in the Lepidoptera," published in the "Transactions" for 1897, as the illustrations would be available to the members, and would enable them to see the close resemblances which these butterflies bear to one another. In whatever direction the mimicry may tend, whether in simulation of inanimate objects such as leaves or twigs or moss, for concealment from their enemies on the one hand or to enable them to secure their prey on the other, in mimicry of conspicuously marked or highly coloured inedible by edible species, in resemblance between two or more equally distasteful but entirely different species, or whatever purpose the mimicry may serve; it seems that the resemblance is in outward appearance only. Although the similarity in colour, pattern, and markings may be so close as to be almost identical, microscopical examination of the wing scales of these insects shows that the details by which the likenesses are brought about may be, and often are, widely different. The specimens from which the examples were taken fall under two groups of mimicry, that of Müller and that of Bates. The Müllerian form of mimicry is that in which two or more highly coloured, conspicuously marked, or peculiarly shaped butterflies, all inedible and distasteful to the insect-eating animals, are so closely alike as to be easily mistaken one for the other. These by their similarity in appearance afford each other mutual protection by dividing between them the total number destroyed by the young Insectivora of each season in learning what is and what is not good for food. The Batesian mimicry is that in which certain conspicuous and nauseous species that the young birds, etc., quickly learn are distasteful, are simulated by others which are not nauseous, but which have acquired the colour-markings of inedible forms and are thereby protected. Amongst the former are the Heliconinae, Danainae and Acraeinae, all of which include amongst their members numbers of highly-coloured species conspicuous for their markings in red, yellow, black and blue, with intermediate tints or shades, and which are easily distinguished in their surroundings. In the latter are included butterflies of nearly every sub-family, and some of the diurnal moths, and both are found nearly all over the world. Yet, on examining with the microscope the scales of the wings of these mimetic butterflies, it will be found that, so far from the similarity in superficial appearance being similarity in detail and pattern, there is a wide diversity in scale structure and arrangement. The scales vary not only in numbers, but in size, colour, and form, and this is the case even where one inedible species mimics another. Mr. Harry Yates exhibited under a number of microscopes tow-nettings from various localities, chiefly Naples, Port Erin, and Stromness. The results of these gatherings, collectively termed plankton, he said differed very much according to locality and time of the year. The state of the weather may also account for the presence of specially abundant species. The young stages of nearly all forms of marine life are to be found in floating condition, at the mercy of tides and currents, thus spreading the species over wide areas.

C. Baker's Engineering Microscope.—This instrument (fig. 1) has been specially designed for the examination and photography of metals (see fig. 2). It contains several distinctive characteristics. As it is intended for the examination of opaque

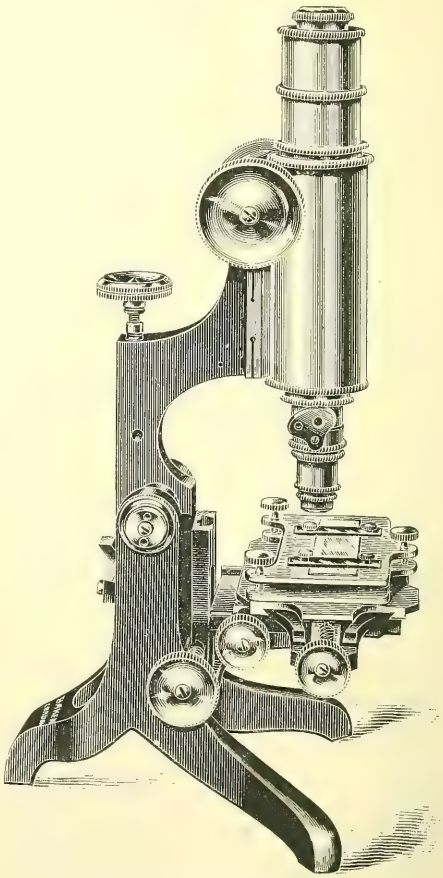


Fig. 1. Engineering Microscope.

objects exclusively, no means of substage illumination is provided, and even no stage aperture. Opaque objects to be examined with moderate powers can be illuminated in the ordinary way by means of a bull's-eye, a side reflector, or a lieberkühn, but with high powers a vertical illuminator must be used. This is simply a collar placed above the objective with a small hole at the side through which a strong light from the lamp is directed, the size of the hole being adjusted by means of a diaphragm. Within the collar is a disc of cover-glass set at an angle of 45°, which without materially

interfering with vision reflects the light down through the objective to the object and back again to the eye. In some illuminators of this type a prism covering half the field of view takes the place of the disc of cover-glass. The body-tube has the usual coarse and fine adjustments; but as it is inconvenient to move it when once the adjustments have been made, the stage is provided with

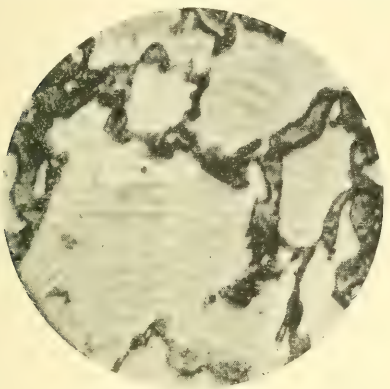


Fig. 2. Photography of Metals. Troostite in a Matrix of Ferrite and Martensite. × 850.

an independent rack-and-pinion focussing adjustment, as well as with mechanical stage and levelling screws for the object under examination. The eyepieces are of the R.M.S. No. 3 gauge. The workmanship and finish of this microscope are of the highest class. The foot is of the solid tripod form, the back leg of which might, however, with advantage be extended a little more, with a view to gain increased steadiness in the horizontal position. The price of the stand alone is £16 16s.

New "Diagnostic" Microscope in "Magnalium."—In addition to the foregoing microscope, Mr. Charles Baker has also submitted for our inspection a "Diagnostic" microscope (Science-Gossip, vol. vi., p. 182) constructed almost entirely of "magnalium," an alloy of manganese and aluminium, and resembling the latter metal in appearance. The total weight is only fourteen ounces. The price of the microscope when in this alloy is £5 10s.

Beck's Portable "London" Microscope.—Messrs. Beck have recently added a portable model to their list of London microscopes (see S.-G., vol. vii., p. 184), in which the back leg of the base slides in, whilst the side legs fold together, the stage itself being removable. In other respects the instrument is the same as the ordinary model, fitted with draw-tube, coarse and fine adjustments, also rack-and-pinion sub-stage, but with the additional advantage of packing into a leather case $9\frac{1}{2} \times 4\frac{1}{2} \times 2\frac{1}{4}$ inches in size. The price of the stand, without objectives, eye-pieces, or condenser, is £6 5s. The "London" microscope is now made in a cheap vertical form, without joint for inclination or sub-stage, and with plain brass stage with wheel diaphragm, but with graduated draw-tube, spiral rack-and-pinion coarse adjustment, micrometer screw fine adjustment, and double mirror, for the sum of £2 13s., complete in mahogany case.

Bausch and Lomb Microtomes.—Messrs. the Bausch and Lomb Optical Company have recently issued a new catalogue of microtomes, and have submitted to our notice several of the instruments listed therein. The most important of these are the Minot Automatic Rotary and Minot Automatic Precision Microtomes, of elaborate construction, and consequent high price, which are more especially designed for advanced work. The laboratory microtomes of this firm are of equal excellence of design and workmanship, if somewhat less elaborate in form. In these the object to be cut is raised by a screw with a feed adjustable from two to sixty micra, the adjustments being so arranged that any desired cutting angle or length of stroke can be had. The knife itself is carried on a V-shaped block. A microtome of this description, with feed operated by hand-lens, is listed at £10 2s., complete with knife and holder. A smaller microtome is of similar design, but the object is raised by a micrometer screw with a pitch of 5 mm., with a graduated head divided into a hundred parts; so that each graduation has, therefore, a value of 5 micra, and there is no automatic feed. This microtome is specially designed for students, and costs, with knife and holder, only £4 11s. 8d. A very substantial table microtome, somewhat of the Leitz type, costs £2 10s. Amongst new designs may be mentioned a simple microtome for freezing with carbon dioxide gas, which can be attached to the gas cylinder.

Mounting Web of Spider.—I found no difficulty in mounting spiders' webs in balsam. I painted a strip of varnish across the two ends of a clean slide, and held this flat against the web; the slide was covered with it, and the oblong torn from the web was held in position by the varnish. I added two or three strands of the big stays or cords supporting the web from the tree, and then left the whole to dry. A few days after I poured on the centre a little balsam dissolved in chloroform, then dropped a cover-glass on it, and left it to dry. The thinnest lines are visible, and the dirt (soot) on them more so. The hawsers, as I call them, show their multiple structure well. The lines which compose the cross threads of the net are smallest, but quite clear and simple. They are as visible in balsam as flax fibre is, and there is no tendency so far to dissolve.—*F. W. Payne, Grove Park, S.E.*

R. & J. Beck's New $\frac{1}{14}$-Inch Oil Immersion Objective.—Messrs. R. & J. Beck, Limited, have sent for our inspection a new $\frac{1}{14}$-inch oil immersion objective. The extra magnifying power over a $\frac{1}{12}$-inch objective is of service in bacteriological and malarial investigation, whilst the price is the same. This lens is made with numerical apertures of 1·0 and 1·25, and sold at £4 and £5 respectively. We have tested the first of these, and can speak favourably of its performance; the corrections are excellent and the working distance ample, whilst the aperture is sufficient for the requirements mentioned, which do not need great aperture. We sometimes question if, in the reaction against objectives of high initial magnification without corresponding increases of aperture, we have not overlooked the advantages that mere magnification will give us in certain investigations—a magnification in excess, at any rate, of the $\frac{1}{12}$-inch immersion objectives that are the highest powers now generally asked for, and to which special attention therefore has been given by opticians. The working distance certainly becomes a difficulty with higher powers, but it is a mistake to suppose that an objective does not

deteriorate in its performance when used with a high-power ocular to gain the needed magnification.

C. Baker's New Catalogue.—Mr. Charles Baker has sent us his latest catalogue, which is an enlargement and revision of the previous issue. The arrangement of the contents might with advantage be copied by other makers. The first division contains particulars of microscopes, illuminating apparatus, mechanical accessories, and apparatus for recording observations, all in due order. The succeeding divisions are devoted to apparatus for collecting, preparing, mounting, and storing specimens; to apparatus for bacteriology, blood examinations, and medical analysis; and to lists of microscopic slides, models, and specimens. Notable features are the explanations and exceptional detail as to measurements in regard to each entry in the catalogue. The very full list of objectives includes those of Leitz, Reichert, and Zeiss, as well as Mr. Baker's own series, and is very convenient for reference. We observe, however, some errors in the calculation of total magnifications with eyepieces of stated powers with a tube-length of 160 mm. The well-arranged list of stains, mainly from the laboratory of Dr. G. Grübler, of Leipzig, will be of service to all microscopists, the list of mounting sundries being equally complete. The pages devoted to mounted objects are considerably extended, especially as regards the slide-lending department (*ante*, pp. 153, 154), and we note that the prices of individual slides have been largely revised, in accordance, we understand, with a suggestion made in these pages when the previous edition of the catalogue was noticed.

ANSWERS TO CORRESPONDENTS.

F. A. H. (Epsom).—The particulars you give are scarcely explicit enough to enable me to help you. Can you give me an exact drawing—or, better still, send the slide itself, that I may be sure to what it is you allude.

[For further articles in this number on Microscopical subjects, see pp. 197 and 200.]

MEETINGS OF MICROSCOPICAL SOCIETIES.

Royal Microscopical Society.—20 Hanover Square, December 18th, 8 p.m.

Quekett Microscopical Club.—20 Hanover Square, December 6th, 7 p.m.; December 20th, 8 p.m.

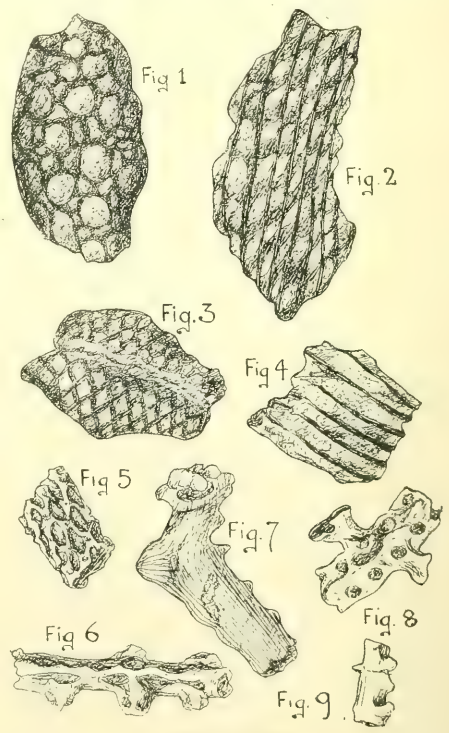
Manchester Microscopical Society. — Grand Hotel, Manchester, December 5th, 7 p.m.; Mounting Section, December 19th, 7 p.m.

Sunderland Microscopical Society. — Subscription Library, Sunderland, December 17th, 7.30 p.m.

EXTRACTS FROM POSTAL MICROSCOPICAL SOCIETY'S NOTEBOOKS.

[Beyond necessary editorial revision these extracts are printed as written by the various members.—Ed. Microscopy, S.-G.]

Fossil Polyzoa.—Figs. 1, 2, 3, and 4 represent fossil Polyzoa from the Wenlock beds of the Upper Silurian. Figs. 5, 6, 7, 8, and 9 represent fossil Polyzoa from the Coal Shales (Scotland) of the Carboniferous period. Allman's definition of Polyzoa is as follows:—"Alimentary canal suspended in a double-walled sac, from which it may be partially protruded by a process of evagination, and into which it may be again retracted by invagination. Mantle surrounded by a crescent of hollow ciliated tentacles. Animals always forming composite colonies." These polyzoa live in colonies or "polyzoaria." Each polyzoarium consists of an assemblage of distinct but similar zoöids arising by continuous gemmation from a single primordial individual. They possess sexual organs and are hermaphroditic. Polyzoa belong to a very ancient race. They seem to have been present in great numbers both in Silurian and Carboniferous beds. Though one branch of the family, the Fenestella or "Lace Corals," appears to have died out with the Carboniferous period, representatives of this large as well as ancient family have existed in more or less abundance throughout a great portion of the Primary, Secondary, and Tertiary Periods, and are, as we know, to be found in many parts of the world at the present time. I have in my possession upwards of sixty fossil species extending over the four great geological periods. The fact that this family has existed so long and varied,



Fossil Polyzoa.

comparatively speaking, so little, shows, to my mind, how well it has been suited from the first to its environment, and how well it has been able to hold its own in the struggle for existence, whilst many of its contemporaries in each of the four great geological periods have become extinct. It may be, however, that the environments have not differed sufficiently to produce any great change, or that the organism is not sufficiently sensitive to such change. See Darwin's "Origin of Species."

(*To be continued.*)

CONDUCTED BY F. C. DENNETT.

	1901 Dec.	*Rises.* h.m.	*Sets.* h.m.	*Position at Noon.* R.A. h.m.s.	Dec. ° ′ ″
Sun ..	1 ..	7.45 a.m. ..	3.53 p.m. ..	16.27.33 ..	21.45. 1 S.
	11 ..	7.57 a.m. ..	3.50 p.m. ..	17.11.11 ..	22.58.32 S.
	21 ..	8. 5 a.m. ..	3.51 p.m. ..	17.55.27 ..	23.26.45 S.
	31 ..	8. 8 a.m. ..	3.58 p.m. ..	18.39.48 ..	23. 8. 5 S.

	Dec.	*Rises.* h.m.	*Souths.* h.m.	*Sets.* h.m.	*Age at Noon.* d.	h.m.
Moon ..	1 ..	10.35 p.m. ..	4.36 a.m. ..	11.37 a.m. ..	20	4.26
	11 ..	7.55 a.m. ..	0.12 p.m. ..	4.30 p.m. ..	0	9. 7
	21 ..	1. 0 p.m. ..	8.25 p.m. ..	2.45 a.m. ..	10	9. 7
	31 ..	11.44 p.m. ..	4.49 a.m. ..	10.51 a.m. ..	20	9. 7

	Dec.	*Souths.* h.m.	*Semi-diameter.*	*Position at Noon.* R.A. h.m.s.	Dec. ° ′ ″
Mercury..	1 ..	10.40·7 a.m. ..	2·7″ ..	15.19.23 ..	16.47.26 S.
	11 ..	11. 2·2 a.m. ..	2·5″ ..	16.20.20 .	21.10.12 S.
	21 ..	11.28·9 a.m. ..	2·3″ ..	17.26.21 ..	24. 2.53 S.
	31 ..	11.58·9 a.m. ..	2·3″ ..	18.35.46 ..	24.52.41 S.
Venus ..	1 ..	3.15·0 p.m.	12·0″ ..	19.53.31 ..	23.43.25 S.
	11 ..	3.17·6 p.m. ..	13·5″ ..	20.35.34 ..	21. 3.34 S.
	21 ..	3.14·9 p.m. ..	15·3″ ..	21.12.23 .	17.46. 8 S.
	31 ..	3. 5·5 p.m. ..	17·6″ ..	21.42.35 ..	14. 8.39 S.
Mars ..	21 ..	1.34·1 p.m. ..	2·1″ ..	19.31.37 ..	22.54.40 S.
Jupiter ..	21 ..	1.24·8 p.m. ..	15·0″ ..	19.22.21 ..	22.21.32 S.
Saturn ..	21 ..	1.13·8 p.m. ..	7·0″ ..	19.11.23 ..	22.14.57 S.
Uranus ..	21 ..	11. 9·7 a.m. ..	1·8″ ..	17. 7. 1 .	22.56.10 S.
Neptune ..	21 ..	0. 5·1 a.m. ..	1·2″ ..	6. 0.27 ..	22.15. 8 N.

MOON'S PHASES.

		h.m.			h.m.
3rd Qr. ..	Dec. 2 ..	9.49 p.m.	*New* ..	Dec. 11 ..	2.53 a.m.
1st Qr. ..	„ 18 ..	8.35 p.m.	*Full* ..	„ 25 ..	0.16 p.m.

In apogee on December 8th, at 2 p.m.; and in perigee on 24th, at 3 a.m.

METEORS.

				h.m.	°
Dec.	1 to 14 ..	Geminids	Radiant	R.A. 7.12	Dec. 33 N.
„	7 to 10 ..	α Geminids	„	„ 7.56	„ 29 N.
„	22 to 29 ..	Canis Venaticids	„	„ 12.56	„ 32 N.

CONJUNCTIONS OF PLANETS WITH THE MOON.

					° ′
Dec.	4 ..	..	Juno† ..	1 a.m. ..	Planet 0.14 S.
„	9 ..	..	Mercury† ..	10 p.m. ..	„ 1.23 S.
„	13 ..	..	Mars*† ..	8 a.m.	„ 5.43 S.
„	13 ..	..	Saturn* ..	10 a.m. ..	„ 4.47 S.
„	13 ..	..	Jupiter* ..	1 p.m. ..	„ 4.58 S.
„	15 ..	..	Venus* ..	11 a.m. ..	„ 7.30 S.
„	31 ..	.	Juno† ..	9 p.m. ..	„ 0.18 N.

* Daylight. † Below English horizon.

OCCULTATIONS AND NEAR APPROACHES.

Dec.	*Star.*	*Magnitude.*	*Disappears.* h.m.	*Angle from Vertex.* °	*Reappears.* h.m.	*Angle from Vertex.* °
14 ..	β Capricorni	3·4 ..	6.43 p.m. ..	9 ..	Below horizon.	
15 ..	ν Aquarii	4·6 ..	6.32 p.m. ..	309 ..	near approach.	
18 ..	λ Piscium	4·7 ..	7.24 p.m. ..	353 ..	8. 9 p.m. ..	272
23 ..	ε Tauri	3·7 ..	5.53 p.m. ..	50 ..	6.12 p.m. ..	11
24 ..	*i* „	5·1 ..	4.28 a.m. ..	142 ..	near approach.	

THE SUN seems to show slightly greater activity. October 10th to 12th and October 28th to November 1st groups of spots were observed in the Southern hemisphere. A fine spot with one or two minute companions has also been visible crossing the disc since November 14th, and was conspicuous on the 18th. There can be no doubt that the minimum had been passed by that date. At 1 p.m. on December 22nd, when the sun enters the sign Capricorn, winter is said to commence.

MERCURY is a morning star, rising in the south-east more than an hour and a half before the sun at the beginning of the month, but its position grows daily worse. At noon on December 18th Mercury is in conjunction with Uranus, passing 28′ south of the fainter planet.

VENUS reaches its greatest eastern elongation, 47° 15′, at 10 a.m. on December 5th, but its great southern declination is not favourable for good observation.

MARS, JUPITER, and SATURN are too near the sun for observation, otherwise the conjunction of Mars with Saturn at 11 a.m. on December 14th, Mars being 1° 18′ south, and that of Mars with Jupiter at 3 p.m. on the 17th, Mars being 52′ to the south, would be interesting phenomena.

URANUS, being in conjunction with the Sun at 9 p.m. on the 9th, is placed in an impossible position for observation.

NEPTUNE, coming into opposition at 2 p.m. on December 22nd, is well situated for observation all the month, retrograding some 3m. 35·3s. just west of η Geminorum.

NOVA 1901 PERSEI has proved to be even more interesting than could have been anticipated. Information has been received from the Lick Observatory that the photographs of nebulous matter amidst which the Nova is situated, taken with the great Crossley mirror, show that four nebulous condensations have a daily motion of 1″·5 towards the south-east. Such are the determinations of Professor Perrine. As was mentioned in SCIENCE-GOSSIP, N.S., No. 88, p. 124, MM. Flammarion and Antoniadi, at Juvisy, in France, had photographed what appeared to be a nebulous aureola around the star, having a definite outline. Mr. Alexander Smith, of Dalbeattie, and Professor Max Wolf, of Heidelberg, both confirmed these observers, and, moreover, all of them have come to the conclusion that the effect has an optical, and not an objective, origin. Indeed it has been found that when the plate is exposed behind an object glass, the star itself is photographed in the usual manner. If the exposure has only lasted a short time, there is an aureola formed around it which gives the star very much the appearance of a sun-spot, an umbra surrounded by a penumbra. If a longer exposure is given, a second aureola makes its appearance around the inner one; and if the exposure is sufficiently prolonged, the inner aureola becomes quite dense. It was noted that the larger aureola was a magnified representation of the smaller, and when Wolf covered over a half of his objective the appearance was found to be present round one-half of a circle. The only explanation at present is, that the star gives out light to which the photographic plates are sensitive, but of so different a wave-length to those usually known that our object-glasses are not sufficiently corrected for them. The reflector brings them to the same focus as the other rays, because its effects are due to reflection and not to refraction. With M. Flammarion's 6½-inch portrait lens of 27½-inch focus, half an hour's exposure showed the star with an image only $\frac{1}{100}$-inch in diameter, the aureola having an angular diameter of 2′. With

3h. 20m. exposure the larger aureola is brought out with a diameter of some six minutes of the arc. The brightness of the star is said to show much less variation.

"OBSERVATION WITHOUT INSTRUMENTS," by Arthur Mee, F.R.A.S. (32 pp., 6½ in. × 4 in., with frontispiece), is a useful brochure for those who want to begin the study of the heavens without instrumental aid. It may be obtained from Messrs. George Philip & Sons, price 3d., or, post free for an additional halfpenny, from its author, Llanishen, Cardiff.

THE PARHELION mentioned on p. 182 of SCIENCE-GOSSIP, No 90, "was observed a little east of the real sun, and equally above the horizon. Mock disc appeared red. The time of day was about 12.30 when the phenomenon was visible."—(*Rev.*) *S. Arthur Brenan, Strand House, Cushendun, Co. Antrim.*

NOVEMBER LEONIDS.—Astronomers were again disappointed with regard to the November leonids in 1901. In many parts of the country cloudy weather prevailed; still some were observed on November 13th and 14th, though not in large numbers. A considerable flight was seen from a vessel off the east coast of America.

CHAPTERS FOR YOUNG ASTRONOMERS.

BY FRANK C. DENNETT.

(*Continued from page* 183.)

SATURN'S SYSTEM (*concluded*).

DURING the opposition of 1899 Mr. H. J. Townshend, of Leeds, saw the Cassini division of the rings passing apparently a little north of the North Pole of the planet, although the portion close to the pole was hidden by the shadow. In 1900 the division seemed to be approaching the limb of the planet as if it would be tangential to the North Pole. This is very much the appearance shown in Mr. Bolton's drawing from the "Memoirs of the British Astronomical Association," reproduced by permission. In 1914 the visibility should be looked for of the division south of the Southern Pole.

The oldest known observation of Saturn was made by the Chaldeans on a date answering to March 1, B.C. 228, when the planet was a little south of γ Virginis. On February 21st, sixteen minutes before midnight in the year A.D. 503, from Athens, Saturn was observed to reappear from the middle of the illuminated limb of the moon, after occultation.

Whiston records that Dr. Samuel Clarke and his father, observing with a 17-foot refractor, about the year 1707 or 1708, saw a star between Saturn and its ring. Dawes once observed a star of less than eighth magnitude pass behind the outer edge of "A," but under unfavourable circumstances. Some time since, the discovery of a ninth satellite of Saturn was announced on the strength of some photographs, but the discovery needs further confirmation. Its orbit was believed to be far outside that of Japetus.

RINGS OF SATURN. (*From drawing by S. Bolton.*)

URANUS.

This giant world is some 30,875 miles in diameter, so that fifty-nine globes the size of the world would only equal it in bulk; yet set in the scale it would need but fourteen times the weight of the earth to balance it, so that, bulk for bulk, it is just a little weightier than Jupiter. A weight dropped on its surface would only fall thirteen feet in the second instead of sixteen feet, as on the earth. It is readily visible to the naked eye as a star of between five and six magnitudes. It has an apparent angular diameter of about 3″·7, so that any good telescope of three inches aperture, or over, will detect that it has a sensible disc; but it appears very "woolly" and ill-defined unless an instrument of at least six inches is employed.

With nine inches Buffham thought he could observe traces of bright patches, and Lassell was once of opinion there might be a spot. Another observer believed he could see belts. Mädler thought he saw, and measured, the ellipticity of the disc as 10″·9, which, with the appearance of the spots, seems to indicate that the rotation is almost from north to south, and is at the same time rapid.

Sir W. Herschel thought that he had discovered six satellites to Uranus, but only two of them

appear to be real; two others were, however, discovered by Lassell and Otto Struve in the autumn of 1847. All four of them are beyond the reach of the ordinary telescope, and they have the peculiarity that their orbits are inclined almost at right angles to the ecliptic (79°), and their motions retrograde as compared with the rest of the systems we have hitherto considered. The distances and periods of the satellites are :—

			d.	h.	m.
Ariel ..	124,000 miles ..	Period	2	12	28
Umbriel ..	173,000 „	„	4	3	27
Titania ..	285,000 „	„	8	16	55
Oberon ..	381,000 „	„	13	11	6

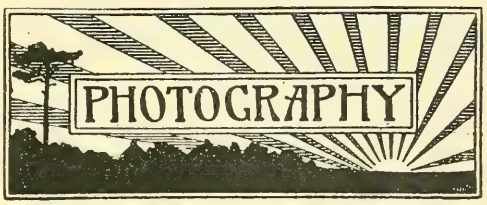
Before the discovery by W. Herschel in 1781 of the planetary nature of Uranus the planet appears to have been observed and recorded as a star no less than nineteen times.

The spectroscope shows the spectrum of Uranus crossed by six broad bands, one occupying the position of a hydrogen line, but the rest are not known.

Neptune.

The story has often been told of the discovery of Neptune, first on paper in England and France, and then with the telescope at Berlin. In real size he is believed to have a diameter of 33,011 miles, which means a bulk 72 times that of the earth, but as his weight, bulk for bulk, is lighter than any other planet except Saturn, only seventeen times the earth's mass is equal to that of Neptune. The latest measures of this planet by Barnard with the 40-inch Yerkes achromatic give its apparent angular diameter as 2·436″. Neptune appears as a star of eighth magnitude, and even with 3·7 inches aperture Webb found it dull and ill defined. Some of the descriptions given of its appearance when discovered are certainly exaggerated, for even with a considerable aperture there is a want of sharpness about the disc, not to be wondered at when one considers the small amount of sunshine that reaches his surface. No spots have been seen, and the spectroscope shows a spectrum very like that of Uranus. In 1883 Maxwell Hall in Jamaica believed that he observed periodical fluctuations of the planet's brightness, which might possibly be owing to a rotation on its axis in less than eight hours. The one satellite discovered by Lassell with his 2-foot mirror on October 10th, 1846, rotates, like those of Uranus, in a retrograde direction. It is about 223,000 miles distant from its primary, has a period of 5 d. 21 h. 8 m., and shines as a fourteenth magnitude star. Dawes saw it steadily with his 8-inch Alvan Clark object-glass, but observation of it is impossible with less powerful instruments. Lassell noted that the satellite was much brighter when preceding the planet than when following, making it very probable that it rotates, like our moon, once on its axis during one revolution. There is good reason for believing that Jupiter, Saturn, Uranus, and Neptune all emit some small amount of light; and it may be that in fact they are, in a small measure, miniature suns in the midst of their satellites. From the irregularities in Neptune's movements the question arises from time to time whether he is the outermost planet in the solar system as he travels along his mighty orbit of 8,376,000,000 miles in the long period of nearly 165 years, only one-third of which has been completed since his discovery in 1846.

(*To be continued.*)



CONDUCTED BY B. FOULKES-WINKS, M.R.P.S.

EXPOSURE TABLE FOR DECEMBER.

The figures in the following table are worked out for plates of about 100 Hurter & Driffield. For plates of lower speed number give more exposure in proportion. Thus plates of 50 H. & D. would require just double the exposure. In the same way, plates of a higher speed number will require proportionately less exposure.

Time, 11 a.m. to 1 p.m.

Between 9 and 11 a.m. and 1 and 3 p.m. double the required exposure. Between 8 and 9 a.m. and 3 and 4 p.m. multiply by 4.

Subject	F. 5·6	F. 8	F. 11	F. 16	F. 22	F. 32	F. 45	F. 64
Sea and Sky ..	$\frac{1}{120}$	$\frac{1}{60}$	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1
Open Landscape and Shipping	$\frac{1}{30}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4
Landscape, with dark foreground, Street Scenes, and Groups ..	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	8
Portraits in Rooms ..	8	16	32	1	2	4	—	—
Light Interiors	30	1	2	4	8	16	32	60
Dark Interiors	2	4	8	16	32	60	120	240

The small figures represent seconds, large figures minutes. The exposures are calculated for sunshine. If the weather is cloudy, increase the exposure by half as much again ; if gloomy, double the exposure.

Exhibition of the Royal Photographic Society of Great Britain.—In our last issue we gave a description of the interesting display of apparatus in the Fountain Court. We now propose to add a more detailed notice of the Pictorial Section, and shall also refer to some noteworthy exhibits in the Technical and Scientific Section. We may at once state that it is our intention to treat the whole subject from a purely photographic point of view. We lay stress on this, as it would appear to be the sole aim of certain exhibitors to produce something as totally unlike a photograph as is possible ; and these people consider this to be "art." The result is arrived at by purely mechanical means, and we are inclined to think often by mere chance. The most simple method of studying the pictures is to go round the room with the catalogue, commencing at No. 1. This is quite an ordinary example of a photograph of woodland scenery in late autumn, by Harold W. Lane, printed in platinum ; but the exhibitor has finished the picture in a prettily-designed mount and frame, which produces a very pleasing whole. The next picture that arrested our attention was No. 14, by James B. Johnson, "Against the Breeze" ; a charming example, full of life and action. It represents a

lady making headway against a strong wind, and the pose of the head, the hand raised to secure the hat, with the boa streaming out over the shoulder, give a sense of reality seldom met with in a pure photograph. It is difficult to understand how the judges passed by such a successful attempt as this No. 14. James Taylor's "Toilers of the Deep," No. 26, is another example of good honest work; and we are glad to see that it has been reproduced in the exhibition catalogue. The charm of the picture lies entirely in the successful attempt to portray the work performed by two fishermen landing their fish. The shine and reflections in the foreground tell the story of a dull, wet day, which is in perfect keeping with the rough but weather-proof clothes of the two men. John H. Gash has, in No. 27, a very good example of his careful work, finished in carbon; it is entitled "Jet Working." No. 36 is one of those unpleasing efforts of Pierre Dubreuil, entitled "Curieuse," being an exceedingly muddy, blotchy, under-exposed plate. No. 39 is another example of the sacrifice of photography for Art, only the Art is not apparent. No. 143 is reproduced in the catalogue, and thus becomes a permanent warning against plate and paper wasting; the print is entitled "Solitude." There are, unfortunately, a good many more photographs more or less after this style, such, for instance, as Nos. 63, 85, 102, 175, 176, 181, 230, and 234. It is with great pleasure we turn back to No. 40, "Burning Ghat, Benares," by C. C. Branch; this is indeed a splendid picture and excellent photography, and we congratulate Mr. Branch upon the successful manner in which he has handled the subject. This gentleman has an equally good photograph in No. 62, "The Maharana's Elephant." Both pictures are printed in carbon. No. 70, "A Puritan Maiden," by T. Fitzgibbon-Forde, is a very pretty bromide enlargement, but has somewhat of an unfinished appearance, due to a rather bad lighting on the face. No. 76 is a lovely picture of autumn woodland scenery by Geo. H. Faux. Amongst the best pictures in the exhibition are the following: No. 92, "The Hour of Rest," by T. E. Corney-Wilson; No. 108, "Landing the Catch," by J. Croisdale Coultas; No. 131, "Her First Grief," and No. 133, "Honesty," both by David Blount; No. 145, "S. Giorgio Maggiore, Venice," by John H. Gear, F.R.P.S.; No. 166, "Un Maitre d'Armes," by Furley Lewis; No. 188, "A Peaceful Afternoon, Kashmir," by G. P. Symes-Scutt; No. 217, "When the Leaves have Fallen," by W. T. Greatbatch, F.R.P.S.; No. 220, "Portrait of a Lady," by W. Crooke; No. 236, "Ready for Market," by W. M. Warneuke, F.R.P.S.; No. 245, "Toilers," by Thos. Carter; No. 274, "An Old Kitchen," by Burnard Moore (medal); No. 277, "The Spinet," by W. Gill, F.R.P.S. (medal); and No. 319, "The Bridal Rose," by Rudolph Erckemeyer, jun. In the Technical Section the medal has been awarded to Douglas English, B.A., for a series of photographs of animals of the rat tribe in their natural habitat. There are also some very fine studies of large animals by H. Nouaille Rudge, No. 517 being particularly good.

CHRISTMAS NUMBERS.—The "Journal of Photography" has issued one of the most beautiful of this year's Christmas numbers. It is about 11 in. $\times 8\frac{1}{2}$ in. in size, with 42 pages and 32 plates. There is a supplement of 16 pages, representing mounts for photographic Christmas cards. Some of the plates are striking in their artistic beauty. There are a number of articles on various subjects, critical and suggestive. The first article discusses and illustrates the work of three prominent French photographers; they are MM. Robert Demachy, C. Puyo, and R. Le Begue. The first is a well-known manipulator of the gum bi-chromatic process. Three of his pictures are reproduced as plates. There is also a plate by the second artist and two by the last-mentioned. The Christmas number of the "Photogram" is also to hand with a frontispiece, representing the choir in Ely Cathedral, by Dr. John W. Ellis. There are interesting notes on "A Seat of Photographic Learning," which is in the Technische Hochschule, Charlottenburg, under the control of Dr. Adolf Miethe. Mr. Ellis Kelsey has an article on "Night Photography at Eastbourne," with numerous illustrations. The children are not forgotten, a pretty series being entitled "Baby and the Gold-Fly."

PHOTOGRAPHY FOR BEGINNERS.

BY B. FOULKES-WINKS, M.R.P.S.

(*Continued from page* 118.)

SECTION II. SHUTTERS.

THE instantaneous shutter on a hand camera is as important as the lens itself, and is worthy of careful consideration. The question is not of so much importance when applied to stand cameras, although we recommend a shutter to be attached to every camera for both time and instantaneous exposures. For ordinary stand cameras we do not think the photographer can do better than use a Thornton-Pickard time and instantaneous roller-blind shutter. This we prefer fitted behind the lens; but if the user is likely to require very short exposures, it will be necessary to also fit the camera with a focal plane shutter. The ordinary roller-blind shutter will give exposures varying from $\frac{1}{90}$th of a second to $\frac{1}{15}$th, and time exposures. A shutter giving a greater range of speeds is the Bausch and Lomb diaphragm shutter, which will give a range from $\frac{1}{100}$th of a second up to 3 seconds, and time. This shutter, however, works between the lenses, and is, therefore, not so convenient when more than one lens is to be used.

A very simple, and at the same time efficient shutter, is the old drop-shutter, which is cheap and also useful for ordinary stand-camera work. There is another almost forgotten shutter, but for landscape work, where high speed is not required, it is one of the best we have ever met with. This is known as the window-blind shutter, and is worked by simply pulling a double-acting roller blind across the front of the lens. It opens at the bottom, passes upwards across the lens, and comes down again, finishing the exposure at the bottom of the opening in the lens. Thus it will be seen that the exposure is considerably more on the foreground portion of the plate than it is to the sky, and in all landscape work this will be found a distinct advantage.

For hand-camera work a shutter must be selected that will give a good range of speeds, varying, preferably, from $\frac{1}{100}$th of a second to half a second, and for time. The shutter should also be what is known as a self-capping or safety shutter—viz. one that will not open when the shutter is set. Such cameras as the "Newman and Guardia," "Adams," "Kodak," etc., are all fitted with these shutters; but where there is the option of selection a

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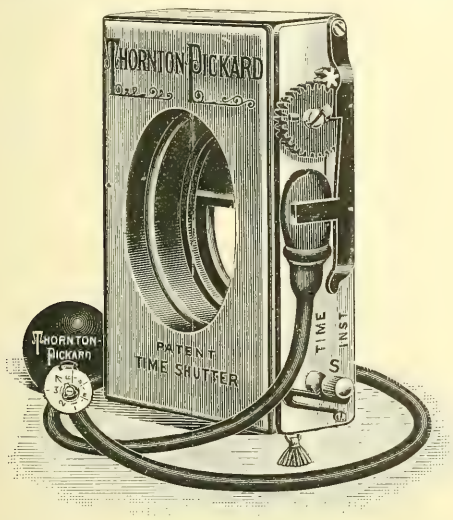
shutter should at least answer these two essential properties; we therefore propose to give a description of the various types of shutters now before the public.

The Roller-Blind Shutter is undoubtedly the most popular ever put on the market, and for years was made solely by the Thornton-Pickard Manufacturing Company. Now it is made by many firms in various forms. The principle of this shutter consists of an opaque blind in the centre of which is an opening: this opening is made to pass rapidly across the front or back of the lens, so exposing the plate. The speed at which this blind travels varies according to the strength of the spring roller, which can be regulated to the required exposure. These rollable blind shutters,



Roller Type of Shutter.

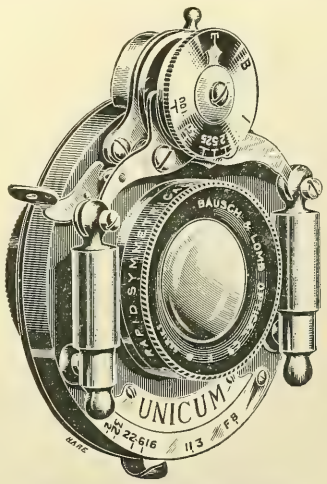
as a rule, open every time the shutter is set. They are, therefore, more suitable for stand cameras than for hand cameras. For time exposures the blind can be arrested midway and prolonged exposure given. The Thornton-Pickard shutter has an indicator fixed to it which indicates the exposure given. The firm also supply a time-value, if required. With this addition the shutter is universal in its use, being capable of giving short time exposures of $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1, 2, and 3 seconds.

The "Diaphragm" Type of Shutter is generally constructed of metal throughout, and the exposure is made by the movement of metal leaves actuated by a spring, the opening and closing of which exposes the plate. The speed at which these leaves move is governed by a pneumatic arrangement. Thus speeds varying from $\frac{1}{100}$th to 3 seconds can easily be obtained. These shutters do not open when setting, and, as a rule, they are supplied with either finger release or with a pneumatic ball attachment. Of this type of shutter the best known are the "Bausch and Lomb Diaphragm" shutter, the "Unicum," the Goerz "Sector," the "Lopa," and the Thornton-Pickard "New Iris" shutter.

The "Focal-plane" Shutter is one that has come very much to the fore of late, and seems likely to stay with us. This is also a blind shutter, but instead of working on the lens it is placed immediately in front of the plate. The blind has a variable slot, which is caused to pass rapidly across the plate, thus exposing the picture thrown upon it by the lens. The amount of exposure is governed by the size of the slot and by the tension of the spring. These are very high-speed shutters, the exposures obtained by their use varying from $\frac{1}{1000}$th of a second to $\frac{1}{20}$th or $\frac{1}{10}$th of a second. When this shutter is used for hand-camera work some means must be devised for covering up the lens whilst setting the shutter, otherwise it will expose the plate during the setting.

The Flap Shutter is one that is used almost exclusively by professional photographers for studio work, and is best known as the "Guerry." The principle is a simple velvet flap, which opens and closes by means of a pneumatic ball. When the ball is pressed the flap is raised, and when the ball is released the flap falls, thus concluding the exposure. It is a most useful shutter where quick exposures are not required, and is very silent and effective.

Foreground Shutters.—There is another class, known as the "Foreground" shutters. To these we have already referred when writing on the "Window-blind" and "Flap" shutters. We have also had the opportunity of testing one known as the "Adjustable." This is a metal shutter in which the exposing portion is raised in front of the lens and returns again to complete the exposure, thus giving considerably more exposure to the foreground than to the sky. The rate of speed at which the exposing piece travels is governed by

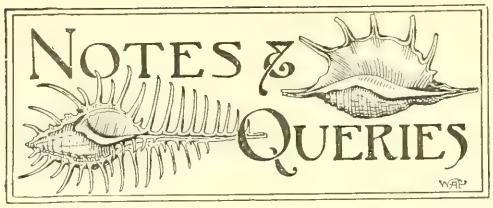


Diaphragm Type of Shutter.

means of a pneumatic piston, and the exposure can be regulated from $\frac{1}{50}$th to a second, and also time can be given.

There are many modifications of these different types of shutters, but they are all more or less alike. Given the class of work the shutter will be required to do, there should be no difficulty in selecting from the foregoing description the most suitable type for any purpose.

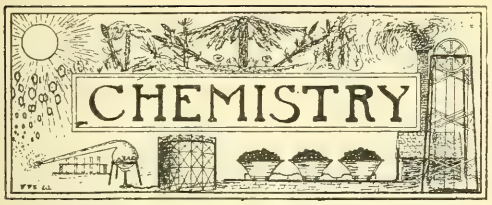
(*To be continued.*)



Japanese Waltzing Mice.—Can any of your readers give any explanation of the remarkable behaviour of Japanese waltzing mice, which continually spin round and round for hours together in their cage? I should be glad also of any information as to their natural condition.—*W. J. Pinckney, St. Leonards-on-Sea.*

Photography *v.* Drawing.—At the close of a lecture before the South London Natural History Society on November 14th a discussion arose on the respective merits of photographs and drawings for the portrayal of natural history objects. The question is of the greatest importance, and one whose consideration is worth the attention of all who may wish to illustrate scientific publications or lectures. As my efforts have been chiefly directed toward the elucidation of the structure and habits of the Araneidea, I think that I had better base these remarks upon that order. For convenience we will consider only the case of workers possessing equal capabilities both in photography and drawing. In the first place, for systematic work intended to facilitate the identification and classification of natural objects, accurate drawings are absolutely necessary. Photographs, if not useless, are of little value without diagrammatic details. In support of this opinion I may state I have never published a photograph of scientific details, although such a procedure necessitates far less labour than the preparation of line drawings. The field naturalist, however, is constantly brought face to face with occurrences, possibly habits inherent to a species, perhaps merely incidents, which may or may not be of scientific value. The delineation of such phenomena would absorb a very considerable, and indeed almost unjustifiable, amount of the time at the disposal of the worker desirous of acquainting himself with the general structure of the representatives of a natural order. The habits of many of these creatures, however, are of absorbing interest, and their consideration undoubtedly tends to detract from the possibilities of a study drifting into the depths of abysmal obscurity, and of its devotees becoming mechanical and soulless slaves to rules and systems. Here photography comes to the rescue, not only as a recreation, but as a means of arousing interest in the minds of other individuals who might, perhaps, in years to come, develop those studies which are in their infancy. Another phase of scientific photography which was discussed was the production of photomicrographs. The necessity of employing artificially flattened preparations is, I agree, a most serious disadvantage, but even these reprehensible productions are not without their uses. In the study of the tarsal claws of spiders crushed preparations are of great value, and the relative length of the joints of the legs may be measured with the greatest facility from photomicrographs. This method not only involves a considerable saving of time, but is an incalculable relief to the eyes of the busy arachnologist. One further point deserves a passing notice. The methods most suitable for lectures may not be thoroughly satisfactory for deep research. A lecture upon a neglected group, delivered before an audience of whom perhaps seventy-five per cent. have already specialised in other studies, and most of the remaining twenty-five per cent. will never enter upon any systematic investigation, should be more or less of a popular nature. Especially should this be the case if the lecturer announces his willingness and desire to help a beginner along the seldom-trodden and labyrinthine paths of the study to whose interests his own life-energies are devoted.—*Frank P. Smith, 15 Cloudesley Place, Islington, London.*

Ice Discs on Leaves.—At the beginning of November there were four days of very thick fog, with several degrees of frost each night. During the day a heavy continuous dropping of the condensed moisture of the fog was taking place under trees. The ground was perfectly dry in places exposed to the sky, but exceedingly wet under the canopy of foliage. Where trees overhung the roads the amount of water deposited became so large that when there was a slight incline it overflowed the dry, dusty portion as a rivulet until it reached the ditch. The roads were thus banded with dry and muddy belts One afternoon during this time I observed a curious phenomenon beneath some hedge-row elms. The road was carpeted with their fallen golden leaves, about half of the year's foliage still clinging to the trees. As I approached I saw that there were strewn irregularly here and there over the surface of the ground a large number of white objects. They were roundish, and from 1½ to 2 inches in diameter. The appearance was as if a quantity of small white poplar leaves had been scattered over the surface. My curiosity was aroused at the sight, and when I came up to the spot I saw that these remarkable disc-like objects were in reality lumps of ice. They were formed of clear transparent ice about one-eighth of an inch thick and were exactly the size and shape of the elm leaves. The condensed fog had accumulated as a layer of water on some of the leaves on the trees that were in a suitable position for such an occurrence, and had frozen on to them during the night. The next day a slight rise in the temperature must have loosened the ice discs from the leaf, and they floated unbroken to the ground, alighting on the strewn leaf-carpet. The leaves on which they had grown may have descended at the same time, but the prostrate discs were dissevered from them, lying quite loosely on their amber couch. The farmer at whose door the phenomenon was occurring had also observed the strange flight, and remarked how "the ice be a-comin' doon from the trees." An event such as this may not be uncommon on the needles of conifers or other evergreen leaves, though I do not recollect having heard of it, but I am inclined to regard it as unusual when taking place on a deciduous-leafed tree. As a rule the leaves will have already fallen from such trees before we enter the climatic conditions which render this feat possible; but fogs and frost set in with sudden and early severity this year. It will be interesting to hear if notes on ice discs reach you from other parts of the country, as the fog spread over a large area.—(*Mrs.*) *I. J. Armitage, Dadnor, Herefordshire, November 9th*, 1901.



CONDUCTED BY C. AINSWORTH MITCHELL, B.A.OXON., F.I.C., F.C.S.

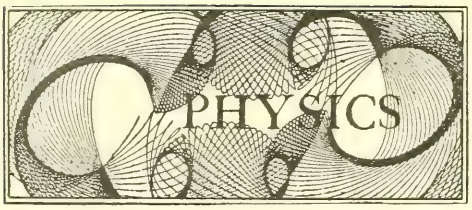
SELENIUM IN BEER.—The element selenium has recently attracted considerable attention from the fact of its having been detected by Tunnicliffe and Rosenheim in a sample of invert sugar, and in two of the samples of the beer which caused the epidemic of arsenical poisoning. Selenium, which is closely allied to sulphur in its physical and chemical properties, was discovered by Berzelius in 1817 in a reddish-brown deposit in the leaden chambers in which sulphuric acid had been manufactured. It is a common constituent of certain varieties of iron pyrites used as the source of oil of vitriol. Like sulphur, it can exist in several modifications, and is known as a reddish-orange deposit, a black vitreous mass, and in the form of crystals. It burns with a bluish flame, the vapours of the combustion having a characteristic unpleasant odour. It combines with hydrogen to form a poisonous gas, known as seleniuretted hydrogen, which when passed through a hot narrow glass tube is decomposed, leaving an orange mirror of selenium on the cooler portion of the tube. It combines with metals to form various selenides which are analogous to the corresponding metallic sulphides. When heated with sulphuric acid it dissolves, forming a green solution, from which the selenium can be separated again on adding a large amount of water. It is said to produce peripheral neuritis, resembling that of arsenical poisoning, though the symptoms are much less marked. Hence the theory was formed that selenium played a distinct though subsidiary part in the recent poisoning epidemic. As, however, hundreds of other samples of beer have been examined without its presence having been detected, the conclusions drawn by Messrs. Tunnicliffe and Rosenheim stand in need of confirmatory experimental evidence.

ALKALINE WATERS FROM THE CHALK.—It has frequently been noted that waters from deep wells in London and other places where the chalk is covered by a layer of clay differ completely in character from waters obtained from the uncovered chalk. Thus in a water of the former class there are only traces of calcium carbonate and magnesium carbonate, but considerable quantities of alkaline salts, and the water is soft and alkaline. On the other hand, in a typical water from the uncovered chalk there is a large proportion of calcium and magnesium carbonates which render the water hard. Various theories, such as the infiltration of sea water, have been proposed to account for the occurrence of alkaline salts in the chalk waters from beneath the clay, but the most satisfactory explanation is that recently offered by Mr. W. W. Fisher. He points out that the London Clay offers an impervious barrier to the passage of the water, which must therefore have slowly travelled through the porous chalk from the outside area, taking up in its passage the soluble salts which are still present to a considerable extent in chalk which has no natural outlet through which these could have been washed away, as in the case of the surface chalk. In this underground journey the proportion of alkaline salts will gradually increase, and the calcium salts show a continual diminution. In support of this theory Mr. Fisher gives the analysis of a specimen of chalk taken from a boring 500 feet deep in the Tottenham Court Road. This chalk was distinctly alkaline, and contained 0·28 per cent. of sodium sulphate, 0·20 per cent. of sodium chloride, and 0·03 per cent. of sodium carbonate.

ARTIFICIAL PRODUCTION OF DIAMONDS.—A process has just been patented in this country by A. Ludwig, of Bernburg, in Germany According to this patent, carbon or graphite is heated by means of an electric current in an atmosphere of a gas, preferably hydrogen, which has been previously compressed to the required extent. The temperature is raised to the point at which the carbon ceases to conduct and is converted into diamond.

IRON IN HENS' EGGS.—Some interesting experiments have been described by P. Hoffmann in the "Zeit. Anal. Chem." It was found that on the average the yolk of an egg contained twelve milligrammes of iron oxide, or that the entire egg without its shell contained 1·8 milligramme. Attempts were then made to increase this proportion by feeding the hens on an organic compound of iron known as ferrohaemol, with the result that the eggs contained a few milligrammes more of iron, and that there was also an increased quantity in the livers of the birds. In similar feeding experiments with organic preparations of copper no copper passed into the eggs.

SALICYLIC ACID IN STRAWBERRIES.—Salicylic acid, which is a derivative of phenol or carbolic acid, was originally prepared from oil of wintergreen (*Gaultheria*), and from salicin, a compound extracted from willow-bark, but is now manufactured by an artificial synthetical process. As it possesses but little taste and has strong antiseptic properties, it has been extensively used as a preservative in various food-products. As regards its influence on the human system there are diverse opinions, but it is significant that the Paris Academy of Science forbid even the smallest addition of salicylates to food, as being liable to cause injury where any weakness of the kidneys or digestive organs exists. Hence there have been many prosecutions of the vendors of foods thus preserved, and considerable attention has been given to the best methods of detecting salicylic acid. A few months ago the Customs authorities in Brazil condemned several Portuguese wines on the ground of their containing traces of the acid, but it was subsequently demonstrated by M. da Silva that certain Portuguese wines contained normally a small quantity of a substance which, like salicylic acid, gave a violet coloration with iron salts. Still more recently Portes and Desmoulières have extracted a similar substance from fresh strawberries, and have identified it beyond doubt as salicylic acid. It was present in the proportion of about one part in a million. As salicylic acid is frequently added to jams as a preservative, the fact of its being a normal constituent of strawberries is of great practical importance.



CONTRIBUTED BY W. H. CADMAN.

USE OF KITES IN STUDYING THE ATMOSPHERE. During the last few years kites carrying meteorological instruments have been employed at several observatories for exploring the upper regions of the atmosphere. One great difficulty, well known to every kite-flyer, prevented anything like systematic observations being made. Unless a sufficiently strong wind was blowing, the kites carrying the physical instruments could not be flown. Strange to say, this obstacle is now overcome by a practical application of that instinctive action of every child when attempting to fly a kite in little or no wind. The artificial wind created by the running child to raise his kite is obtained on a larger scale by means of a rapidly-moving tug-boat. In this way large kites can be raised in comparatively calm weather by the motion of the earth-end of the kite string or wire. Mr. A. L. Rotch raised his instruments to a height of 2,670 feet, and states that his kites rose easily and steadily in the artificial wind. His experiments show conclusively that, with a steamer which can be manœuvred at will, kites can be flown at sea in almost all weather conditions. A great field is thus opened for investigation of the conditions existing at various heights of the atmosphere above the ocean. All such records of the barometric pressure, air temperature, relative humidity, and wind velocity will be of great value to science. It is gratifying to learn from the "United States Monthly Weather Review" that the German South Polar Expedition will systematically make kite ascensi ns in the Antarctic regions. The expedition was fully equipped before starting with kites of three sizes suitable for lifting and sustaining the instruments in high or light winds. An account of the exploration of the upper air conditions in the Polar regions will be very welcome.

DENSITY OF AQUEOUS SOLUTIONS. — The "Comptes Rendus" contains an account by L. C. de Coppet on the "Maximum Density of Aqueous Solutions." The author has made a careful study of the lowering of the temperature of maximum density of water produced by the solution of various chlorides, bromides, and iodides, chiefly those of the alkali metals. In accordance with the law of Despretz, the lowering of the temperature of maximum density is found to be proportional to the quantity of substance dissolved, and except in the case of lithium the molecular lowerings are nearly constant.

ATTRACTION OF MOSQUITOES BY SOUNDS.—At this time, when the destruction of these insects is so much needed, because of the relation between them and the spread of yellow fever, any information about their habits must be of general interest. Sir Hiram S. Maxim's observations in New York are remarkable. One evening he found everything in the neighbourhood of a box containing the dynamo machine, under an electric lamp, covered with small insects, which were identified as mosquitoes. On closer inspection he perceived that the box emitted a feeble musical note, the sound of which attracted the mosquitoes. Although there was a larger proportion of female mosquitoes in the district, only the males were attracted to the box by the sound. Sir Hiram Maxim remarks that "when the lamps were started in the beginning of the evening, every male mosquito would at once turn in the direction of the lamp and, as it were, 'face the music,' and then fly off in the direction from which the sound proceeded. It then occurred to me that the two little feathers on the head of the male mosquito acted as ears, and vibrated in unison with the music of the lamp; and as the pitch of the note was almost identical with the buzzing of the female mosquito, the male took the music to be the buzzing of the female." This explanation seems quite feasible when it is remembered that in no case was a single female attracted by the sound. The above observation may prove of valuable assistance to those who are now experimenting upon the best means of destroying these fever-spreading insects.

ZEEMAN EFFECT.—A paper on "Asymmetry of the Zeeman Effect" has been communicated to the London Physical Society by Mr. G. W. Walker. An asymmetry of the normal triplet was predicted by Voigh and verified by Zeeman, and as the result of mathematical investigation it is now found that asymmetry may arise as a second-order term due to the magnetic field. The effect, which is extremely small, would be more distinct the greater the field, and it is claimed that the theory provides an explanation of the reason why a line may not be resoluable.

CHANGE OF MAGNETIC RESISTANCE OF METALS. Some very interesting results upon the change of magnetic resistance for various metals have recently been obtained by Mr. Guy Barlow, one of the first Fellows of the University of Wales. The conclusion arrived at by previous investigators on this subject was that the change of magnetic resistance is directly proportional to the square of the magnetisation. Mr. Barlow's experiments, carried out in the laboratory of Professor E. Taylor Jones at Bangor, prove that this is not the case. The metals were used in the form of wire surrounded with non-conducting material and enclosed in glass tubes. These were further surrounded by other glass tubes, through which a steady flow of water passed. In this way great care was taken to keep the temperature of the wires perfectly constant. The importance of these precautions will be seen, when it is remembered that the change of resistance of a metal wire placed in a magnetic field is always small, so that variation of resistance, with any alteration of temperature, might easily swamp the effect of magnetisation. Mr. Barlow's first series of experiments were made with the axis of the wire along the lines of magnetic force. Electro-magnets of widely different strength were used for obtaining the magnetic field. The ordinary Wheatstone's bridge method was used for measuring the resistance, though elaborate precautions were taken to avoid contact currents; and eventually very consistent readings were obtained with the galvanometer. The results of the experiments were plotted in curves, which in the case of soft iron, nickel, and steel, the metals employed, were

far from being straight lines. These were compared with the magnetisation curves obtained in the usual manner. Mr. Barlow's result has an important bearing upon the theory of electromagnetism, for it shows conclusively that change of magnetic resistance is not proportional to the square of the magnetisation. He obtained the empirical formula $\Delta\phi = aI^2 + bI^4 + cI^6$. The hysteresis curves plotted by Mr. Barlow are entirely new, and present many beautiful symmetrical figures.

Colour of the Sky.—Professor J. M. Pernter has contributed a paper to the Vienna Academy of Sciences on the polarisation of light in turbid media, considered with reference to the colour of the sky. He finds a very close agreement between the two phenomena, and thus confirms experimentally Lord Rayleigh's theory of the colour of the sky.

Hailstorm Artillery.—The study of hail and thunder storms is receiving considerable attention in Italy and Austria. In Italy several stations have been organised for the purpose of experimenting as to the possibility of dispersing thunder-clouds by gun-firing. In response to the enthusiasm of Italian agriculturists in the matter, the Government has voted a sum of money for the establishment of two shooting stations in suitable localities, and has provided them with the most sensitive instruments for predicting the advance of storms. In some cases the firing appears to have had a favourable effect, while in others the firing apparatus was choked by the falling hail. Mr. W. N. Shaw states in "Nature" that the practice of firing off gunpowder to protect vineyards from hail is spreading in Austria. Cylindrical mortars, provided with conical mouthpieces, are used for the purpose. The vortex rings discharged from the large mortars have been found to reach a height of 400 metres only, which is considerably short of the level generally occupied by the storm-clouds. This seems to show that the vortex rings would hardly ever reach the clouds, so that until more powerful apparatus is employed the results can rarely be satisfactory.

Experiments with Human Subjects.—The determination of the efficiency of a man during a six days' bicycle race in France has an interesting bearing on the question as to whether organic life is subject to the second law of thermodynamics or whether Maxwell's "demons" actually exist in the animal kingdom. The "Journal de Physique" gives a lucid account of experiments upon the "Thermal Conductivity of the Human Skin," by J. Lefèvre. The author made absolute determinations of the thermal conductivity of the skin of a human subject by calculating the coëfficient of heat emission from the external surface, the coëfficient of heat transmission through the skin, and the coëfficient of the heat restoration on the inner surface of the skin. The subject was immersed always to the same depth in water at different temperatures. The skin area in contact with the water was estimated with the aid of a tightly fitting garment. The external skin temperature was estimated with the help of a thermocouple, and also the inner temperature was found by inserting a needle-shaped thermocouple into the skin, the thickness of the skin varying from 1·5 to 2 mm. The coëfficient of conductivity is found to be of the order of that of guttapercha.

FIELD BOTANY.

CONDUCTED BY JAMES SAUNDERS, A.L.S.

Surrey Plants in 1901.—Early in March *Galanthus nivalis* and *Eranthis hyemalis* were in flower on Headley Heath—the snowdrop with double flowers, being presumably of garden origin, and the winter aconite probably so. *Helleborus foetidus* was seen at its old locality at Headley Lane, and *H. viridis* was found between Chipstead and Tadworth, the latter locality being one of four fresh localities in which the green hellebore has been met with in Surrey. Between Chipstead and Tadworth grow the white-flowered form, *leucantha*, of *Viola silvestris*; also *Luzula maxima*, a reputedly rare plant in Surrey, but the great wood-rush is found in at least five widely-separated localities in the county. In May *Trigonella* was flowering on Mitcham Common. Here I was unsuccessful in finding *Ranunculus parviflorus*, which the preceding year was growing sparingly on a grass-grown bank. Mitcham Common is an old-recorded locality for this species. During June a walk on the hills north of Oxted was rewarded in seeing nine of the British orchids, and later in the month ten species of these plants were observed in the neighbourhood of Horsley. Other interesting plants of the country south-west of Horsley are, *Arenaria tenuifolia*, *Polygala oxyptera*, *Valeriana mikanii*, *Orobanche elatior*, and the early summer flowering variety (*praecox*) of *Gentiana amarella*. *Pilularia globulifera* has been exterminated at Holmwood Common, and also, apparently, at Earlswood Common. It is, therefore, satisfactory to be able to mention that the pill-wort grows in the neighbourhood of Ockham so abundantly as would seem to defy the fate that has befallen it elsewhere. In this same district grow *Damasonium stellatum*, *Juncus diffusus*, *Lycopodium inundatum*, two sundews, *Littorella*, etc. On Epsom Common in August were seen in flower the duckweed *Lemna gibba* and *Erythraea pulchella*. In this neighbourhood two more localities for *Pilularia* were met with. A plant that has not been recorded in recent times for the county is the viscid groundsel, *Senecio viscosus*. It grows at West Dulwich, where I have seen it during the past ten years. When in the neighbourhood of Dorking, I encountered two such local plants as *Pulicaria vulgaris* and the variety *pseudo-botryoides* of *Chenopodium rubrum*.—*C. E. Britton*, 35 *Dugdale Street*, *Camberwell*, *London*, *S.E.*

Mycetozoa of Switzerland.—It is desired by some of the leading Swiss botanists to publish a list of all the species of the mycetozoa that have been recorded for that country. Up to the present time only forty-six forms can be catalogued, although of course many examples of the commoner kinds have been found. It is probable that persistent search in damp woods, especially in the early autumn, would speedily double the number

of records. Any of the readers of SCIENCE-GOSSIP who may have Swiss gatherings of this group, either named or non-named, would greatly oblige if they would communicate with the writer.—*James Saunders, A.L.S., Luton, England.*

MOSSES NEW TO IRELAND.—The Rev. H. W. Lett, M.A., records, apparently for the first time, three species of mosses that have been found in Ireland. They are *Campylopus shawii*, from Co. Cork; *C. schimperi*, from Co. Kerry; and *Dicranum uncinatum*, from Co. Mayo. These are interesting on account of their extended range in the British flora, all three species having previously been only known to occur in a few localities in Scotland.

TEACHING OF BOTANY.—In the October number of "The Record of Technical and Secondary Education" is an exceptionally interesting illustrated article by Miss Ethel A. M. Webb with regard to the teaching of botany in schools. It is one of a series of articles on "Nature, Knowledge Schemes" and the utilisation of museums. In this article Miss Webb describes a successful experiment at Warrington, where object-lessons are arranged for the guidance of children, and been largely appreciated not only by them, but also by many of their elders.

STRUCTURAL AND PHYSIOLOGICAL BOTANY.

CONDUCTED BY HAROLD A. HAIG.

RECENT RESEARCH ON CENTROSOMES.—Professor Bernard (Recherches sur les Sphères attractives chez *Lilium candidum*, *Helosis guayanensis*, etc., "Jour. de Botanique," September 1901) is convinced of the presence of centrosomes in *Lilium candidum* and *L. martagon*. In the former they were found quite regularly during the various phases in germination of the megaspore. They were also observed in gametophytes of *Helosis*; and, moreover, the centrosomes appear to be cytoplasmic in origin. In the same paper it was pointed out that there are occasionally two embryo-sacs in *L. candidum*. This would, of course, be the result of the further division of the original cell of the archesporium, which usually goes to form only the single megaspore. The paper in question does not state whether both embryo-sacs contain potential nuclei, capable of undergoing the usual changes subsequent to fertilisation, but it may fairly be assumed that only one is a potential embryo-sac if the analogous phenomenon of polyembryony holds good in this respect.

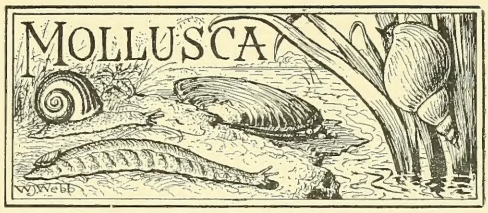
MATERIAL FOR STUDY OF CAMBIUM. — In Dicotyledons and Gymnosperms the study of the ring of meristem that occurs between the xylem and phloëm—in other words the cambium—is of great importance in relation to the formation of the secondary phloëm and xylem. Another interesting point is the consideration of the origin of the interfascicular cambium by the extension of the ring between the primary bundles, thus ultimately giving rise to secondary bundles. It is no easy matter to select good material for the preparation of sections, either transverse or longitudinal. It is only by the careful preservation of such material in suitable hardening or fixing reagents that we are enabled to keep it in good "cutting" order, by which is meant that the tissues must be neither too hard nor too soft, yet retaining their original bulk, with little or no contraction. For this purpose a 2 per cent. solution of osmic acid is a very good preservative and hardening reagent; but even in this some of the more delicate tissues, notably the cambium, get brittle after long standing. We are inclined to the belief that ordinary alcoholic spirit forms a very fair preservative for most vegetable tissues, and certainly the results hitherto obtained have served to strengthen this belief. The actual selection of material is to be taken more or less hand in hand with the practically tested degree of contraction experienced by that material when placed in the preserving medium. It is no use studying cambium in plants that experience great contraction on fixing, such as do most succulent plants which contain a large amount of cell-sap. The best thing is to select plants having a liberal amount of pith in the centre of the stem, so that if any contraction is to occur it may have some resistance to contract against. In this way the contour of the stem is preserved, and this is not the least important point in the preservation of the cambial ring. We have found young shoots of the hop plant (*Lupulus*) give very satisfactory results in this respect, as there is a good central core of growing pith which certainly aids in preventing the outlying tissues from contracting very much. *Sambucus* (elder tree) is another good plant in which to study the cambium, and in sections of young shoots that have been treated with eau de Javelle previous to staining very fine results may be obtained. The sunflower gives fairly good results with sections of the stem; but in this case the presence of very hard bands of sclerenchyma, situated at various points of the circumference, make it difficult to get good sections, seeing that the razor is a little blunted before it even gets to the cambium. The main points, then, to be observed are: (1) Select material that will not suffer much contraction in keeping in the preservative medium; (2) ascertain by test sections that there are no mechanical difficulties in the cutting of the section, such as would be produced by hard bands of sclerenchyma; (3) take a plant in which the cambial ring is of fair extent in the radial direction.

CILIARY ACTION IN PLANTS.—Amongst the Thallophyta (Protococcaceae) we find minute organisms which are endowed with the power of motion. Such are *Protococcus*, *Chlamydomonas*, and some others. As is well known, they owe this power to the possession of cilia, which in some cases are so long as to deserve the term "flagella" being applied to them. If we observe carefully under a microscope one of these organisms—in the case under examination it is *Sphaerella*—we find that, unless the light is regulated by means of the condenser until a semi-dark field is produced, we can see little or nothing of the to-and-fro lashing movements of the two cilia situated at the so-called "anterior pole" of the organism. Having, however, stopped down the iris diaphragm to very nearly its limit, we can occasionally catch sight of them—that is, when the organism is more or less stationary, or only rotating. The flagella in the case examined are very long and delicate, and, if carefully fixed and stained preparations are made, can be seen under a high magnification to be processes of the outer protoplasmic lining of the organism that lies next the cell-wall; in other words, the "ectoplasm." The rate of movement of

cilia in the members of the Thallophyta which possess them seems to be far more rapid than that occurring in the Protozoa. If one compares the rates of ciliary motion in, say, *Vorticella* and *Protococcus* this will appear obvious, since it is possible to easily observe the movements of the fringe of cilia round the epistome of *Vorticella* in brighter light than in the case of the cilia of *Protococcus*. I am here assuming that good definition in ciliary action depends upon three conditions: *i.e.* (1) rate of movement of the cilia; (2) size of cilium; and (3) the amount to which the light has to be stopped down by the condenser diaphragm. The latter condition is necessary in order that the edges of any object may be well defined. The ultimate explanation of ciliary action has not yet been arrived at, but one or two theories have been advanced, the most justifiable of which holds that a cilium is hollow, and that the more fluid endoplasm is alternately forced into and drawn back again from the cavity, thus producing the lashing movements. Yet, again, it is probable that the ectoplasm of the cilium is peculiarly irritable, and that under the influence of certain external conditions it is stimulated to contract in such a manner as to produce the motions peculiar to it. It may be that these two suppositions are both partly correct, and that both phenomena occur simultaneously. It is interesting to compare the differentiations of motile structures arising from the ectoplasm as we work up from lower to higher Thallophyta. In the lower forms, such as the plasmodia, we find simple prolongation of the ectoplasm or pseudopodia put out with a very low degree of motility, whereas in such forms as *Sphaerella* we have delicate structures, or cilia, with a considerable power of rapid motion.

Photography of Diatoms.—Mr. P. C. Myers ("Journal of Applied Microscopy," September 1901) gives some very useful hints with respect to the photography of diatoms. He obtains some fine results by using a dry apochromatic objective (3 mm. of ·95 N.A.), and as oculars compensating eyepiece No. 8 and projection eyepiece No. 4. These data may be of some use to photo-micrographers. The diatoms are mounted preferably in styrax. In the article mentioned there are numerous figures, showing results, magnified some 2,500 diameters. Considering the magnification, the definition obtained is remarkably good.

Structure of the Cocoanut.—For a most excellent article on the "Anatomy of the Fruit of *Cocos nucifera*" the reader is referred to the October number of the "American Journal of Science," wherein Mr. A. L. Winton gives a very full account of the macroscopic structure, histology, micro-chemistry, and chemical composition of that most useful article, the cocoanut. The accompanying illustrations form a striking point in the article, and even from those alone the student and agricultural expert may learn a good deal. When one considers the difficulty that must have been experienced in obtaining good sections of the various layers—epicarp, mesocarp, and endocarp—of which the cocoanut is composed, and in all of which there are a great number of hard sclerised elements (stone-cells of endocarp), the value of the figures is easily recognised. A peculiarity that will be noticed is the presence of circular or elliptical cells on the surface of the mesocarp fibres, in the walls of which crenated siliceous bodies are found.



Carychium minimum, Müller.—One does not often hear much about the variations of a species so small as *Carychium minimum*. We may be inclined to think that the smaller species of animals may be so situated in the scheme of biological economy that they are less subject than their larger-grown relatives to those combinations of circumstances which give rise to a marked lack of uniformity among a number of individuals. The following notes are derived mainly from a study of about 240 specimens obtained from the refuse left by a flood in the Thames on Hinksey Marsh, in Berkshire, during the winter of 1898–9. (i) *Armature of the Mouth.*—Normally the peristome presents three projections into the aperture: one from that part which is reflected over the body-whorl (posterior), one from that part immediately anterior to the termination of the columella (lateral), and one from the free portion (anterior). The posterior one is always the best developed, and may properly be called a denticle; the other two are blunter and less defined tubercles. During the formation of the peristome they appear in the order posterior, anterior, lateral; and the latter is often very poorly developed. In some instances it is completely absent, and there is nothing to mark its site. The same is true less frequently of the anterior tubercle. We have not noted a specimen without the posterior denticle, except where the whole aperture is malformed. In the series, however, all three projections were present in every specimen; the lateral one was frequently much reduced, but always plainly marked, as were the other two. (ii) *Variation in Size.*—The length has been carefully measured in 200 specimens with the aid of a microscope and a camera lucida. Measurements were made to 0·01 mm., and may probably be taken as correct to 0·02 mm. The length was taken parallel to the axis of the shell. The results are given grouped to the nearest 0·05 mm. to save elaboration of the table:—

1·70 mm.	.. 3	1·95 mm.	.. 37
1·75 „	.. 7	2·00 „	.. 25
1·80 „	.. 27	2·05 „	.. 17
1·85 „	.. 27	2·10 „	.. 7
1·90 „	.. 47	2·15 „	.. 3—200

The mean of all the specimens is 1·919 mm., maximum 2·16 mm., minimum 1·70 mm. I have previously recorded ("Woolhope Transactions," 1898–1899, p. 77) that in Herefordshire hardly any variation in length was to be detected; but the present measurements show that this series varies about as much as any ordinary series of most other British land snails. The following table contrasts these specimens of *Carychium* with a series of *Tachea nemoralis*:—

	Within 10 % of mean	Within 5 % of mean	Extreme Variation Above mean	Above mean
C. minimum	.. 95·5	66·0	12·5	11·4
T. nemoralis	.. 94·9	81·0	14·3	12·5

(iii) *Variation in Shape, etc.*—These are difficult to describe, but the following points may be noted:—(α) The mouth varies in shape and in the angle which its greatest diameter makes with the axis of the shell. (β) The depth of suture and the apparent or real tumidity of the whorls vary. (γ) The relative diameters of the apical and basal whorls vary a good deal, producing (with similar variations about the peristome) specimens which may roughly be contrasted as being cylindrical, conical, or fusiform. (δ) The texture of the shell seems to differ to a certain extent in different individuals. On the whole, the species seems to offer a good field for anyone who cares to describe and name a number of fresh varieties.—*Arthur E. Boycott, Hereford, October 6th*, 1901.

NOTICES OF SOCIETIES.

Ordinary meetings are marked †, excursions ; names of persons following excursions are of Conductors. Lantern Illustrations§.*

GEOLOGISTS' ASSOCIATION.

Dec. 6.—§ "Notes on a Recent Visit to Egypt." C. W. Andrews, D.Sc., F.G.S.

NORTH LONDON NATURAL HISTORY SOCIETY.

Dec. 10.—† Annual Business Meeting.
„ 17.—§ Holiday Papers: 1. Mrs. Robbins; 2. L. B. Hall.
„ 17.—Special Exhibition of Members' Lantern Slides.

SELBORNE SOCIETY.

Dec. 6.—§ "Palaeolithic and Neolithic Men and the Tools they Used." N. F. Robarts, F.G.S.

HAMPSTEAD SCIENTIFIC SOCIETY.

Dec. 6.—† General Meeting. "The Human Eye." Dr. A. Hugh Thompson, M.A., M.D.
„ 11.—§ Photographic Section, Lecture on "Practical Landscape Photography."
„ 13.—§ Natural History Section, "Parasites." A. W. Stokes, F.C.S., F.I.C.
„ 20.—† Photographic Section, "Hints to Beginners." P. Joshua.

LAMBETH FIELD CLUB AND SCIENTIFIC SOCIETY.

Dec. 2.—§ Lecture, "Our Northern Constellations." F. P. Perks.
„ 14.—* Visit to Science Galleries, South Kensington (Astronomical Instruments). J. J. Hall, F.R.A.S.

SOUTH LONDON ENTOMOLOGICAL AND NATURAL HISTORY SOCIETY.

Dec. 12.—†, "A Few Weeks in Central Spain." Dr. Chapman, F.Z.S., F.E.S.

ANSWERS TO CORRESPONDENTS.

A. H. (Rochdale).—"Text-book of Palaeontology," by Karl A. von Littel, translated and edited by Charles R. Eastman, Ph.D., is one of the latest and most satisfactory books on the subject. Published 1900 by Macmillan & Co., London. Get Vol. I. first, with 1,476 woodcuts of Invertebrata, price 25*s.* net. It is better to pay a good price for a first-class book than less for one that may be misleading. See SCIENCE-GOSSIP, Vol. VI., page 349, for full description.

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